

Oral Health in Missouri - 2020



A Burden Report by



Oral Health in Missouri – 2020
A Burden Report by the Missouri Department of Health and
Senior Services

Revised as of November 16, 2020

For more information contact: Office of Dental Health
Missouri Department of Health and Senior Services

oralhealth@health.mo.gov

<http://oralhealth.mo.gov>

This report is also accessible via the internet at:

<http://oralhealth.mo.gov>

Suggested Citation:

Missouri Department of Health and Senior Services (2020). Oral Health in Missouri – 2020: A Burden Report by the Missouri Department of Health and Senior Services.

The following Office of Dental Health staff contributed to this report:

John Dane, DDS, FAAHD, DABSCD, FACD, State Dental Director
Julie Boeckman, BS, Public Health Program Manager
Mahlet Gemechu, BA, MPH, Associate Research/Data Analyst
Kally Kline, BA, Public Health Program Specialist
Gwen Sullentrup, BA, Public Health Program Specialist
Dione Snitker, Lead Administrative Support Assistant
Jeffrey Bellamy, BS, RDH, Project Specialist
Beth Cameron, M.ED., RDH, Project Specialist
Audrey Hendee, BS, RDH, Project Specialist
Ann Hoffman, BSDH, RDH, Project Specialist
Molly McBride-Mooty, RDH, Project Specialist
Susan Connell, Health Program Aide

Acknowledgements:

Special thanks to the schools and community partners that participate
in the Preventive Services Program and Basic Screening Surveys.

Mo HealthNet data provided by the Missouri Department of Social Services.

Community Water Fluoridation data and map provided
by the Missouri Department of Natural Resources.

Federally Qualified Health Center dental site locations provided by
Karen Dent of the Missouri Primary Care Association.

Table of Contents

Executive Summary	7
Introduction	7
Methodology	8
National Oral Health Surveillance System	9
Table 1. Missouri vs National Statistics from National Oral Health Surveillance System	10
Missouri Demographics	10
Table 2. Missouri Population Estimates by Age Group and Sex, 2018	10
Table 3. Missouri Population Estimates by Race, 2018	11
Community Water Fluoridation	11
Figure 1. Percent of Population Served by Community Water Systems Receiving Optimally Fluoridated Water, Missouri vs Nationwide, 2018	11
Children	12
<i>Fluoride Varnish</i>	12
Figure 2. Total PSP Participants by School Year	13
<i>Oral Hygiene</i>	14
Figure 3. Unsatisfactory Oral Hygiene among Third Grade Students, BSS 2019 vs PSP 2018-2019	14
Table 4. Poor Oral Hygiene by Age Group	14
Figure 4. Poor Oral Hygiene by Race and Ethnicity	14
<i>Dental Sealants</i>	15
Figure 5. Dental Sealants among Third Grade Students, BSS 2019 vs PSP 2018-2019	15
Table 5. Percent of Sealants by Age Group and Sex	15
Figure 6. Dental Sealants by Race and Ethnicity	15
<i>Decay Experience</i>	16
Figure 7. Decay Experience among Third Grade Students, BSS 2019 vs PSP 2018-2019	16
Figure 8. Prevalence of Decay Experience, Nationwide 2015-2016	16
Figure 9. Decay Experience among Third Grade Students, 2013-2019	16
<i>Untreated Decay</i>	17
Figure 10. Untreated Decay among Third Grade Students, BSS 2019 vs PSP 2018-2019	17
Figure 11. Untreated Decay, National 2015-2016	17
Figure 12. Untreated Decay (Any Tooth) – All Grades by Race and Ethnicity, PSP 2018-2019	17
<i>Urgent Dental Treatment Needed</i>	18
Figure 13. Urgent Dental Treatment Needed among Third Grade Students, BSS 2019 vs PSP 2018-2019 ..	18
Figure 14. Urgent Dental Treatment Needed – All Grades by Race and Ethnicity, PSP 2018-2019	18
<i>Nutrition</i>	19
Table 6. High School Students – Percent that Reported Selected Dietary Behaviors in the Last Week, Missouri 2009	19
<i>Cleft Lip and Palate</i>	19
Table 7. Selected Missouri Resident Birth Defects and Craniofacial Anomalies: Counts and Rates per 10,000 Resident Live Births, 2011-2016	19
Adults	20
<i>Dental Visits</i>	20

Figure 15. Percent of Adults Visited Dentist in the Past Year, Missouri vs National Median (n=53)	20
Table 8. Percent of Adults – Visited a Dentist in the Last Year, Missouri vs National Median (n=53), 2018..	20
Table 9. Percent of Adults – Visited a Dentist in the Last Year, 2018	21
Figure 16. 2016 Dental Visit in the Past Two Years (Map)	22
Tooth Loss	23
Figure 17. Percent of Adults – Any Permanent Teeth Extracted, Missouri vs National Median (n=53), 2012-2018	23
Table 10. Percent of Adults – Any Permanent Teeth Extracted, Missouri vs National Median (n=53), 2018.	23
Table 11. Percent of Adults – Any Permanent Teeth Extracted, Missouri, 2018	24
Figure 18. Percent of Adults 65 Years and Older All Permanent Teeth Extracted, Missouri vs National Median (n=53), 2018-2018	24
Table 12. Percent of Adults 65 Years and Older – All Permanent Teeth Extracted, Missouri vs National Median (n=53), 2018	25
Table 13. Percent of Adults – All Permanent Teeth Extracted – Missouri, 2018	25
Chronically Ill	26
Table 14. Percentage of Population Affected by Selected Chronic Health Indicators, Missouri vs National Median (n=53), 2018	26
Tobacco Use and Risk	26
<i>Tobacco Use – High School Students</i>	27
Figure 19. High School Students – Current Cigarette Use Missouri vs Nationwide, 2019	27
Figure 20. High School Students – Current Cigarette Smoking Missouri vs Nationwide, 2011-2017	27
Figure 21. High School Students – Current Electronic Vapor Product Use, Missouri vs Nationwide, 2019 ...	28
Figure 22. High School Students – Current Electronic Vapor Product Use, Missouri vs Nationwide, 2017-2019	28
Figure 23. High School Students – Current Smokeless Tobacco Use, Missouri vs Nationwide, 2019	29
Figure 24. High School Students – Current Smokeless (Chewing) Tobacco Use Missouri vs Nationwide, 2017	29
<i>Tobacco Use – Adults</i>	30
Figure 25. Adults – Current Cigarette Use by Gender, Missouri, 2018	30
Figure 26. Adults – Current Cigarette Use, Missouri vs National Median (n=25), 2011-2018	30
Table 15. Current Cigarette Use by Race and Ethnicity, Adults 18 Years and Older, Missouri, 2018	31
<i>Tobacco Use – Pregnant Women</i>	31
Figure 27. PRAMS Tobacco Use Indicators, Missouri 2013-2017	31
Figure 28. Any Cigarette Smoking Nationwide, 2017	32
Cancer Incidence and Mortality	32
Figure 29. At Least 1 Dose of HPV Vaccine Coverage, Missouri 2016-2018	32
Figure 30. At Least 2 Doses of HPV Vaccine Coverage, Missouri 2016-2018	33
Figure 31. Up-to-Date Doses of HPV Vaccine Coverage, Missouri 2016-2018	33
Figure 32. Age-Adjusted Incidence Rate per 100,000 Population by Sex – Oral Cavity and Pharynx Cancer, Missouri 2016	34
Figure 33. Oral Cavity and Pharynx Cancer Incidence Rate per 100,000 Population, Nationwide – 2016.....	34
Figure 34. Age-Adjusted Incidence per 100,000 Population by Race – Oral Cavity and Pharynx Cancer, Invasive Disease, Missouri, 2016	35
Figure 35. Oral Cavity and Pharynx Cancer Incidence Rate per 100,000 Population, Missouri 1999-2016...	35

Figure 36. Nationwide Age-Adjusted Oral Cavity and Pharynx Cancer Incidence Rate per 100,000 Population, 1999-2016	36
Figure 37. Oral Cavity and Pharynx Cancer Incidence, Missouri – 2012-2016 (Map)	37
Figure 38. Age-Adjusted Death Rates per 100,000 Population by Sex – Oral Cavity and Pharynx Cancer, Missouri and Nationwide, 2016	38
Figure 39. Oral Cavity and Pharynx Cancer Death Rate per 100,000 Population by Sex and Race/Ethnicity, Nationwide – 2016	38
Figure 40. Oral Cavity and Pharynx Cancer Mortality Rate per 100,000 Population, Missouri 1999-2016	39
Figure 41. Nationwide Oral Cavity and Pharynx Cancer Mortality Rates per 100,000 Population, 1999-2016	39
Figure 42. Oral Cancer Death Rates, Missouri 2016-2016 (Map)	40
Older Adults	41
<i>Perinatal Oral Health</i>	41
Figure 43. Percent of Pregnant Women Who Responded Regarding Their Oral Health, 2018	41
Figure 44. Percent of PRAMS Participants – Teeth Cleaned During Pregnancy, Missouri 2012-2017	42
Figure 45. Percent of PRAMS Participants – Teeth Cleaned During Pregnancy, Nationwide 2015-2017	42
Figure 46. Percent of PRAMS Participants – Visited a Dentist During Pregnancy, Missouri 2016-2018	43
Figure 47. Reasons for Not Going to the Dentist (percent yes, all that apply), Missouri 2018	43
Hospitalizations and Emergency Department Visits	44
Table 16. Number and Rate* of ED Visits for Dental Complaints vs All Visits by Year, Missouri Residents 2011-2017	44
Figure 48. Dental Complaints – ED Visit Rate per 1,000 Population by Age Group and Year, Missouri 2011, 2017	45
Figure 49. Dental Complaints – ED Visit Rate*per 1,000 Population by Payment Source, Missouri 2011-2017	45
Figure 50. Dental Complaints – ED Visit Rate per 1,000 by Payment Source and Age Group, Missouri Residents – 2015	46
Figure 51. Dental Complaints – ED Visit Rate* per 1,000 by Race, Missouri Residents 2015-2017	46
Figure 52. Missouri Dental Related ED Visits, 2017	47
Table 17. Dental Complaints – Inpatient Hospitalization Data, Missouri Residents 2016-2017	47
Table 18. Dental Complaints – Hospital Discharges, Missouri Residents 2011-2017	48
Access to Care	48
<i>Dental Health Professionals</i>	48
Figure 53. Dentists Per County, 2019 (Map)	49
Figure 54. Dental Hygienist Per County, 2019 (Map)	50
Figure 55. Dental Delivery Sites – 2019	51
<i>Dental Coverage</i>	52
Figure 56. Missourians Who Last Visited a Dentist More than Two Years Age, 2016	52
Table 19. MO HealthNet Utilization Rates for Dental Services – State Fiscal Year 2018	52
Figure 57. Total Number of Children Eligible to Receive Any Dental Services, 2019	53
Figure 58. Total Number of Children Eligible to Receive Sealant on Permanent Molar Tooth, 2019	53
Conclusions	54
References	56

Executive Summary

Oral Health in Missouri – 2020: The purpose of this report is to describe oral health trends and disparities in Missouri and to disseminate those findings to citizens, stakeholders, partners and decision makers. The format of this report is based on the model of an oral health “burden report” as defined by the Centers for Disease Control and Prevention (CDC) and the Association of State and Territorial Dental Directors (ASTDD), and includes context, national comparisons and trends over time for each finding.

Oral Health in Missouri – 2020 will be used internally by the Office of Dental Health (ODH) to develop Missouri’s new state plan, to improve oral health surveillance and to guide interventions. This report is also available for organizations, communities and decision makers to guide their programs and initiatives.

Key Findings

- Currently, 75.6% of Missourians served by community water systems receive optimally fluoridated water, which is better than the percentage for the nation as a whole.
- Missouri adults with higher educational attainment and higher annual income are twice as likely to visit the dentist as individuals from the lowest socioeconomic group.
- Missouri adults older than 65 years of age from the lowest socioeconomic group were five times more likely to have lost all of their permanent teeth due to tooth decay or gum disease than individuals from higher socioeconomic groups.
- Among Missouri residents, only 64.4% of women visited a dentist and 45.4% had their teeth cleaned during their most recent pregnancy.
- There are approximately 57,000 emergency department (ED) visits due to non-traumatic dental complaints among Missouri residents annually; based on national estimates, these visits cost approximately \$21 million per year.

Recommendations

- Oral health initiatives should focus on preventive measures such as fluoride varnish, dental sealants and community water fluoridation.
- All Missourians should receive more education about the need for regular dental visits and the importance of oral health for their overall health, but this is especially important for those of lower socioeconomic groups and individuals with chronic disease.
- Dentists, dental hygienists and medical providers should be leveraged to educate patients about key issues, such as oral cancer and dental care during pregnancy.
- Improvements to the distribution and availability of oral health professionals, especially those that serve low-income individuals, are recommended in order to decrease tooth loss in adults and reduce the use of hospitals for non-traumatic dental complaints.

Introduction

The Surgeon General’s report Oral Health in America - 2020 states that oral health is essential to general health and well-being. The consequences of poor oral health range from difficulty eating, speaking and learning in children to missed work, adverse diabetes and pregnancy outcomes, and risk of heart disease and stroke in adults. The report also states that good oral health is achievable by all, but not everyone has achieved the same degree of oral health. The most vulnerable individuals are more affected by poor oral health, including children living in poverty, the elderly and members of racial and ethnic minorities.¹ A new Surgeon General Report will be released in the fall of 2020. The

report is expected to focus on the importance of poor oral health as a public health issue, describe issues affecting oral health and call upon all Americans to take actions in improving oral health.²

The Missouri Office of Dental Health (ODH) has been conducting oral health surveillance for many years. The ODH collects and reports data on fluoridation of community water systems, conducts the Basic Screening Survey (BSS) on school-aged children every five years, and coordinates the collection of oral screening data on each child that participates in the Preventive Services Program (PSP), an oral health education and prevention program for children. The ODH receives data from other programs within the Department of Health and Senior Services (DHSS) that coordinate the collection of multiple rich data sources that are directly and indirectly related to oral health.

Ultimately, the purpose of Oral Health in Missouri – 2020 is to compile and contextualize all available oral health data, identify gaps where additional data need to be gathered, disseminate findings to the public and stakeholders and use the information to guide interventions and policies within DHSS.

Methodology

Oral Health in Missouri – 2020 is based on the format of a “burden report” using guidance from the ASTDD and the CDC. Whenever possible, state-specific findings are compared to national data to depict what the status of oral health is for Missourians. Some national data are based on a median for all states and territories or all states that participate in a particular type of surveillance activity while other data has national percentages or rates that are directly comparable to Missouri findings. Trend data are also displayed when available to determine if findings are changing over time. Comparisons to relevant *Healthy People 2020* oral health objectives are included whenever possible. Disparities by age, sex, race ethnicity and socioeconomic status are also reported when available.

The CDC’s Water Fluoridation Reporting System (WFRS) collects data on community water fluoridation (CWF) for all states. The system allows for comparisons between Missouri’s current status and the national percentage of individuals on community water systems that receive optimally fluoridated water. The Missouri Department of Natural Resources (DNR) provided the ODH with CWF data from its State Drinking Water Information System, which the ODH enters into the WFRS system on a quarterly basis.

BSS is used to conduct a standardized oral health screening on children in selected populations. The 2019 BSS screened children in the third grade from a representative sample of public elementary schools in Missouri. The sampling frame included all public non-virtual schools with 20 or more children in the third grade. The sampling frame was stratified by rural/urban status of the county where the school is located and percent of the school’s students eligible for the national school lunch program. Visit the link below for more information on the 2019 report.³

<https://health.mo.gov/living/families/oralhealth/pdf/oral-health-3rd-grade.pdf>

The distinction between adjusted and unadjusted findings is clearly noted on each figure for the third grade students. It is important to note that a new BSS is planned for the school year 2024-2025 to be carried out according to ASTDD approved guidelines.

PSP results for the 2019-2020 school year are compared alongside the 2019 BSS results to provide additional context. PSP screenings follow the BSS template; however, the PSP is a voluntary community-based program rather than a subset of randomly selected schools. Although PSP data are not from a random sample, the population is large; out of roughly 91,000 children screened, 13,321 (15%) were third graders additionally, the PSP included participants in nearly every Missouri county.⁴ Additional PSP findings for all grade levels including analysis by race, ethnicity, sex and age group are also included. For information on the PSP, the demographics of its participants and additional screening results from the 2018-2019 school, please visit the following link.

The Behavioral Risk Factor Surveillance System (BRFSS) is an important source of information on oral health status and related risk factors. Randomly selected adults (18 years of age and older) are asked to participate in a telephone interview; due to this random selection, the results are generalizable to the population as a whole.⁵ All available oral health trend data are reported. National data for several years are provided by CDC for comparison to state-specific findings.⁶ The median for all 50 states, District of Columbia and two territories (n=53) was selected for this national comparison. Missouri also conducted a special County-Level Study using methods and techniques compatible with the BRFSS, which allows for county level data and provides more community-level information for local assessment and decision making. Data from the BRFSS and County-Level Study are each reported as age-adjusted rates except in the case of age-specific analyses.

The Youth Risk Behavior Survey (YRBS) provides risk factor data for high school students (ninth through twelfth grades). The YRBS is also the product of a sampling design that allows information to be generalized to the population at large.⁷ National data are also available for comparison.

Missouri participates in the Pregnancy Risk Monitoring System (PRAMS), which collects data on a sample of all women who have had a recent live birth in order to answer questions about pregnancy and the first few months after birth. The sampling methods employed ensure the findings are generalizable.⁸ PRAMS data were obtained from internal DHSS partners as well as from a CDC site that presents Missouri's data alongside findings from other states, allowing for a national median to be calculated for comparison.

Data on cleft lip, cleft palate and other craniofacial defects included in this report were provided by the DHSS Birth Defects Registry and were selected from Missouri Resident live births during a specific period of time.

Missouri and national statistics for oral and pharyngeal cancer were obtained from CDC's National Program of Cancer Registries; the Missouri Cancer Registry contributes to this data system, which allows for comparisons at the state and national levels by sex, race and ethnicity.

Missouri is fortunate to have the Missouri Information for Community Assessment (MICA) system, which displays Patient Abstract System data, including inpatient hospitalizations and ED visits. These data include figures by payment source, race, ethnicity, age, sex and county of residence for ED visits and inpatient standard population; data for specific age groups are crude rates.

National Oral Health Surveillance System

This table summarizes the most recent statistics for each measure contained within the National Oral Health Surveillance System and relevant *Healthy People 2020* objectives. This may be used as a high-level view of Missouri's current status as well as a guideline for the establishment of goals seeking to improve oral health in Missouri.

Table 1. Missouri vs National Statistics from National Oral Health Surveillance System				
Indicator	Missouri	National	National Measure	HP 2020 Objective
Percentage of Adults Who Have Visited a Dentist in the Last Year	63.3% 2018	67.3% 2018	Median, N=53	N/A
Percentage of Adults Who Have Had Teeth Cleaned in the Last Year	61.7% 2018	69.0% 2018	Median, N=53	N/A
Complete Tooth Loss Among Adults 65 and Older	65 and Older: 18.8% (65 to 74 year-olds: 15.7%) 2018	65 and Older: 13.5% 2018	Median, N=53	65 to 74 year-olds: 21.6%
Loss of 6 or More Teeth Among Adults 65 and Older	42.8% 2016	36.0% 2016	Median, N=53	N/A
Percent Served by Community Water Systems that Receive Fluoridated Water	75.6% 2018	73.0% 2018	National Percentage	79.60%
Caries Experience Among Third Grade Students	54.8% 2018-2019	50.5% 2015-2016	National Percentage	6 to 9 year-olds: 49%
Untreated Tooth Decay Among Third Grade Students	28.5% 2018-2019	15.3% 2015-2016	National Percentage	6 to 9 year-olds: 25.9%
Dental Sealants Among Third Grade Students*	29.7% 2018-2019	42% 2011-2014	Median, N=53	6 to 9 year-olds 28.1%
Cancer of the Oral Cavity and Pharynx Incidence	12.6 per 100,000 population 2016	11.7 per 100,000 population 2016	Age-adjusted incidence rate	N/A

*See page 55

Missouri Demographics

Over six million individuals reside in Missouri. About a quarter of Missourians are children younger than 18 years of age. About 60.6% are adults 18 to 64 years old and 16.9% are 65 years and older. There is slightly more females than males statewide, especially among adults 65 years and older.⁹

Table 2. Missouri Population Estimates by Age Group and Sex, 2018			
Age Group	Female	Male	Both Sexes
Under 18 Years of Age	11.0%	11.5%	22.5%
18 to 64 Years of Age	30.5%	30.1%	60.6%
65 Years and Older	9.4%	7.5%	16.9%
All Ages	50.9%	49.1%	100.0%

Data Source: Missouri Information for Community Assessment

The majority of Missouri's population is white; 12.6% are African-American and about 3.2% are other races (including Asians, Pacific Islanders and Native Americans). Only about 4% of Missourians are of Hispanic ethnicity.⁹

Table 3. Missouri Population Estimates by Race, 2018	
White	84.2%
African-American	12.6%
Other Races	3.2%

Data Source: Missouri Information for Community Assessment

Missouri is comprised of 16 urban and 99 rural counties, passed on population density and proximity to a Metropolitan Statistical Area. Even though the majority of Missouri's geographic area is considered rural, only about 2.07 million Missourians reside in rural areas compared with 4.05 million residing in urban areas.⁹

About 14% of Missourians are living in poverty, defined as 100% of the Federal Poverty Level (FPL) established by the United States Department of Health and Human Services (HHS) poverty guidelines; this is slightly higher than the percentage reported for the United States as a whole (12.7%).^{10,11} In Missouri, over 1 in 6 children (18.5%) live in poverty compared to just 11.9% Missouri adults.¹² For the 2016-2017 school year, about 52% of Missouri's public school students were eligible to receive a free or reduced-price lunch.¹²

Community Water Fluoridation

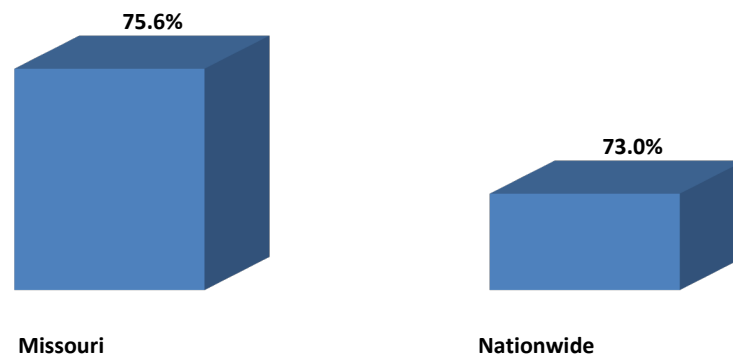
Tooth decay occurs when bacteria on the teeth produce acids that destroy tooth enamel. Fluoride in various forms has been demonstrated to slow this process called demineralization; fluoride also increases re-mineralization. While tooth decay is mainly preventable, it still remains as one of the most common chronic disease for children aged 6 to 11 and adolescents aged 12 to 19 years. Water fluoridation has been a main factor in reducing the rate of tooth decay.¹³

CWF is a safe and effective way to prevent tooth decay. It is also the most cost effective way to provide protection for cavities to individuals of all ages and socioeconomic groups.¹³ Missouri communities have been participating in CWF since 1954.

Current national data show that about 73.0% of all individuals served by community water systems are receiving optimally fluoridated water. That is, fluoride levels within water are adjusted to ensure it is the optimal level of fluoride at 0.7 parts per million (ppm) as recommended by CDC. A slightly higher percentage is reported for Missouri at 75.6%, which is below the current Healthy People 2020 objective of 79.6%.^{14, 15} Visit the link below for more information on fluoride in specific communities.

<https://health.mo.gov/living/families/oralhealth/waterfluoridation.php>

Figure 1. Percent of Population Served by Community Water Systems Receiving Optimally Fluoridated Water, Missouri vs Nationwide, 2018



Data Source: CDC's Water Fluoridation Reporting System

Children

Dental caries has been called the single most common chronic childhood disease.² Left untreated, tooth decay can result in problems with eating, speaking and learning. Poor oral health may lead to inadequate nutrition, pain, infection, missed school, depression and low self-esteem – all of which impact the ability to learn. Children from low-income families are at greater risk for poor oral health and its consequences.¹⁶

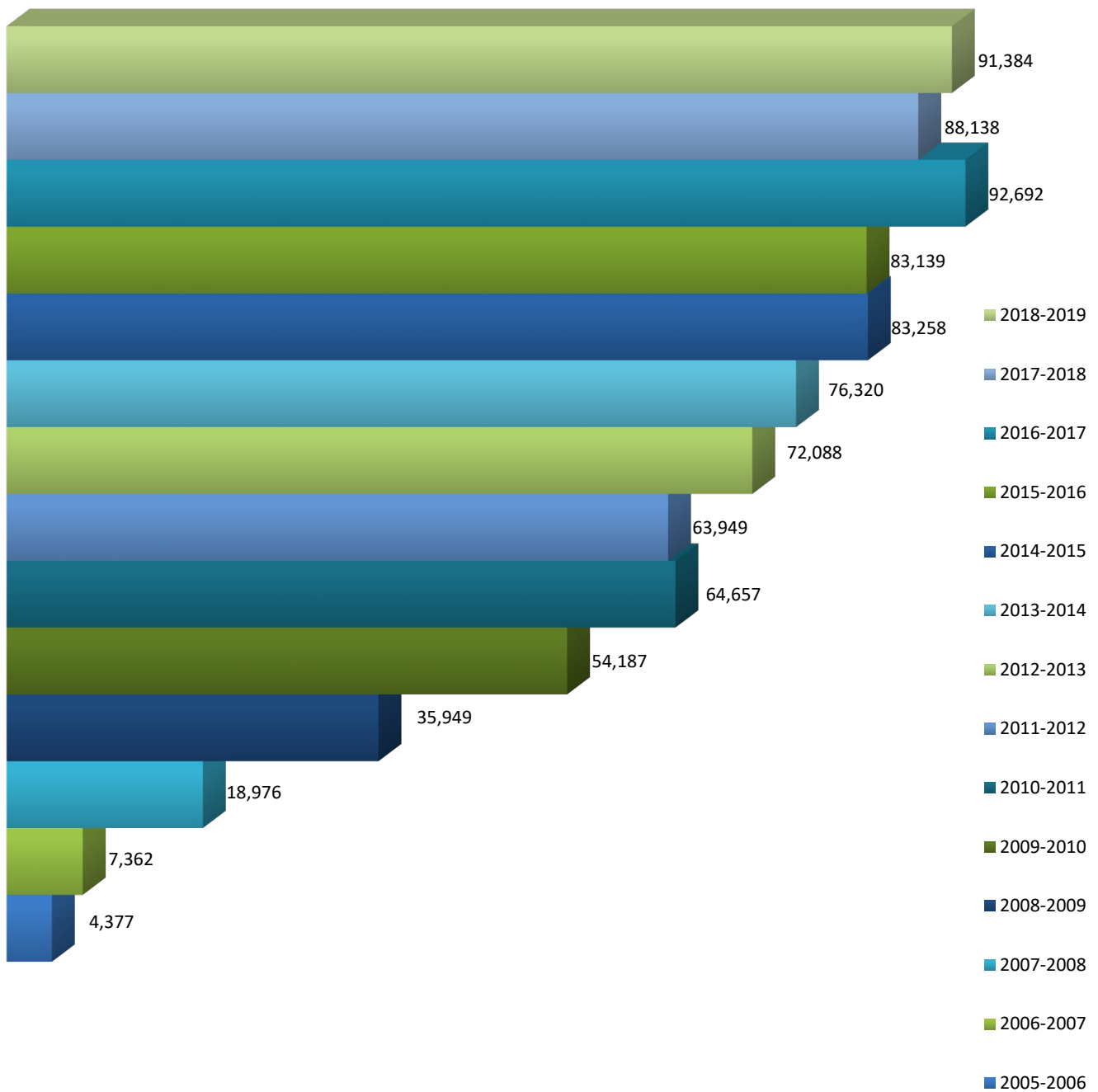
Fluoride Varnish

Fluoride varnish is topically applied to the outer surfaces of teeth to prevent cavities. It dries fast and only takes minutes to apply. Fluoride varnish helps re-mineralize weakened tooth enamel and prevent about 40% of cavities in primary teeth. It is recommended by experts that infants and children should receive fluoride varnish when teeth first erupts.¹⁷

Missouri's PSP follows this model of an evidence-based fluoride varnish program. Participants receive oral health education, supplies (such as toothbrush, toothpaste and dental floss), an oral health screening and an application of fluoride varnish. The varnish is applied twice per school year for each child.

The PSP is a voluntary community-based program that is provided to any school, day care center, Head Start or other group that wishes to participate. The ODH employs five regional Oral Health Consultants who are Registered Dental Hygienists that coordinate PSP events in nearly every county in Missouri. This strategy has been successful; the PSP has been growing each year since its inception during the 2005-2006 school year, with more than 91,000 children served in 2018-2019 school year.

Figure 2. Total PSP Participants by School Year

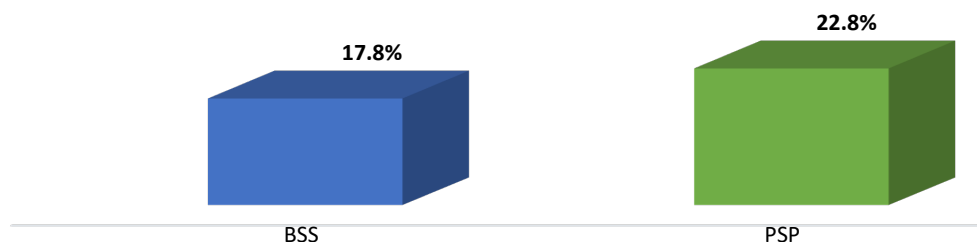


The PSP is a voluntary community-based program; however, as noted in the methodology section, results from third grade PSP screenings in the 2018-2019 school year are reported alongside the 2019 BSS, which was conducted on a random sample of third graders. This provides additional context for each screening's results. When available, comparisons to relevant *Healthy People 2020* objectives are also provided. Additional PSP findings for participants of all grade levels are reported so measures can be examined by demographic factors like sex, race, ethnicity and age group.

Oral Hygiene

Maintaining satisfactory hygiene is another important strategy for preventing tooth decay. According to BSS and PSP findings, between 19 and 22.8% of third graders had unsatisfactory oral hygiene, including visible plaque and inflamed oral tissues. A greater proportion of third grade students were identified as having unsatisfactory oral hygiene in the 2018-2019 PSP screening than in the 2019 BSS.

Figure 3. Unsatisfactory Oral Hygiene among Third Grade Students, BSS 2019 vs PSP 2018-2019



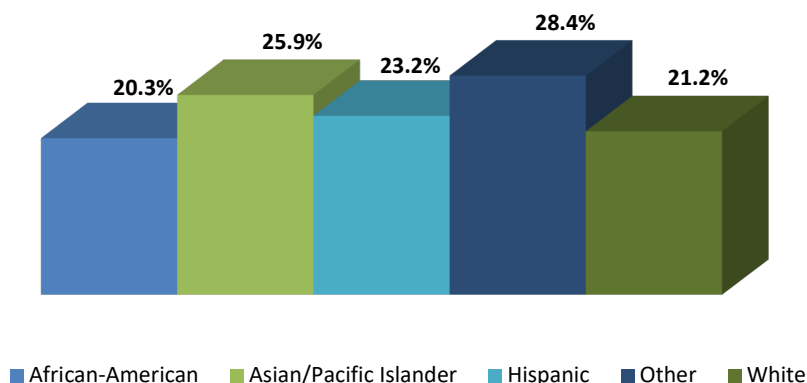
During the 2018-2019 school year, poor oral hygiene was noted among about 22% of participants of all ages. The percent with poor oral hygiene was lower among younger children in general but higher among males of all ages.

Table 4. Poor Oral Hygiene by Age Group

Age Group	Female	Male	Total Poor Oral Hygiene
0-5 Years old	1.2%	1.7%	2.9%
6-12 Years Old	7.6%	9.8%	17.4%
13 Years and Older	0.5%	0.8%	1.3%
Total	9.3%	12.3%	21.6%

Poor oral hygiene was noted most frequently among children identified as “Other” and least frequently among African-American children.

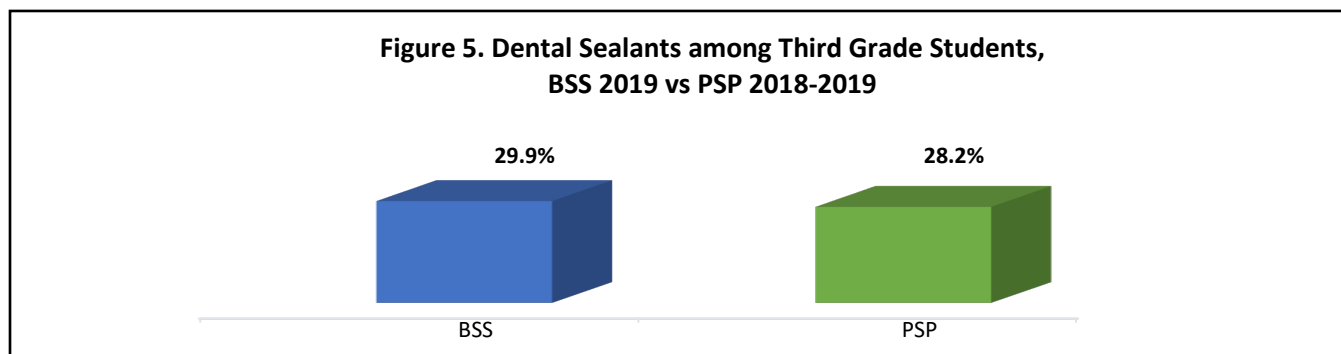
Figure 4. Poor Oral Hygiene by Race/Ethnicity



Dental Sealants

Dental sealants are thin plastic coatings applied to the chewing surfaces of back teeth where tooth decay often occurs in children. Typically, dental sealants are applied to permanent molar teeth soon after they have erupted. The first molars usually erupt around age 6 and the second molars tend to erupt by age 12. Dental sealants can be applied easily and last for several years.¹⁸

BSS students had more sealants placed compared with PSP students.



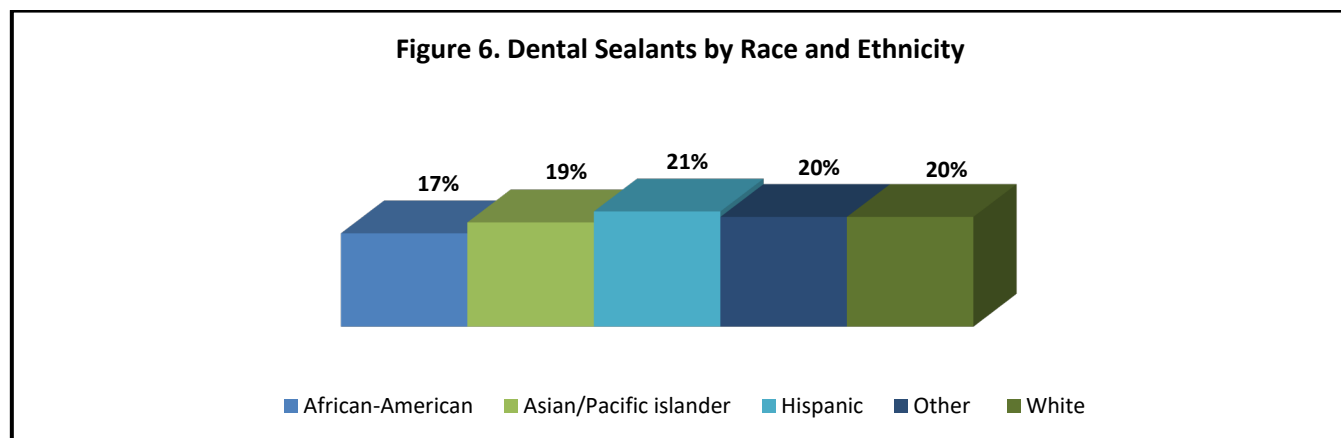
The Healthy People 2020 objective related to dental sealants that is the most comparable to BSS and PSP findings is to increase the proportion of children 6 to 9 years of age with dental sealants on at least one permanent molar to 28.1%.¹⁹

Among PSP participants of all ages/grades in the 2018-2019 school year, about 19% had dental sealants. Most guidelines recommend that sealants be placed on newly erupted permanent teeth. The rate of dental sealants is higher among children between 6 to 12 years old.

Table 5. Percent of Sealants by Age Group and Sex*			
Age Group	Female	Male	Total Sealants Placed
0-5 Years Old	0.1%	0.1%	0.3%
6-12 Years Old	8.9%	8.6%	17.5%
13 Years and Older	0.8%	0.7%	1.5%
Total	9.9%	9.5%	19.3%

*See page 55

Dental sealants were observed most frequently among White, Hispanic and Other children and least frequently among African-American children.



Decay Experience

Decay experience is a measure of any treated or untreated decay found on any primary or permanent teeth during screening. Decay experience was higher among third graders in the PSP program compared with BSS participants. The decay experience national rate was lower compared with the Missouri rates. However, the national data used children between 6 to 11 years old.

Figure 7. Decay Experience among Third Grade Students, BSS 2019 vs PSP 2018-2019

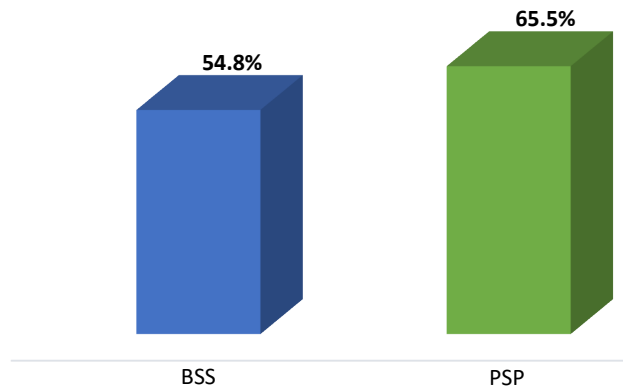


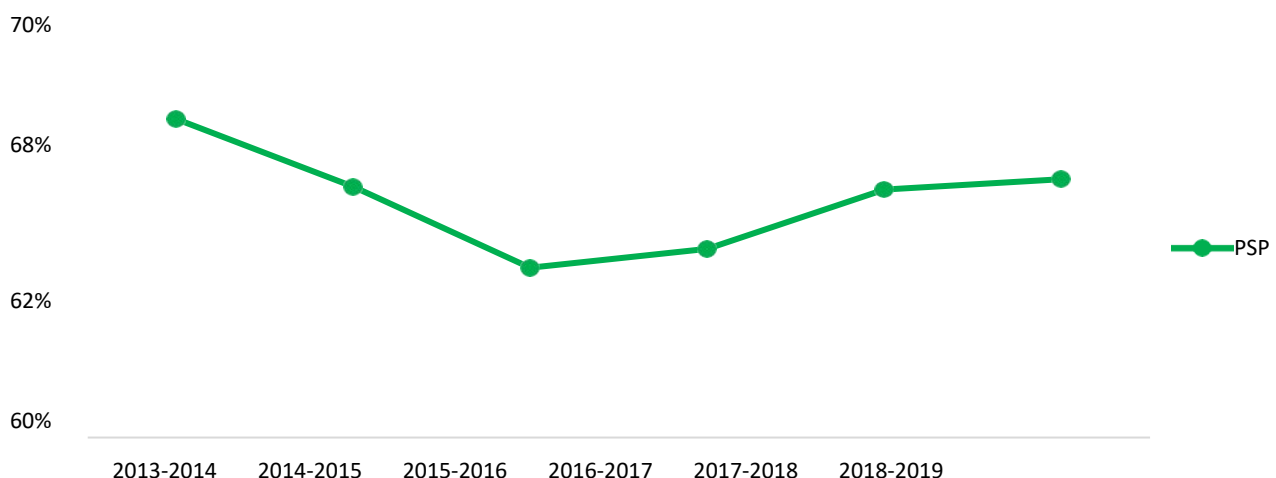
Figure 8. Prevalence of Decay Experience, Nationwide 2015-2016



A *Healthy People 2020* national objective has been set regarding decay experience (also called dental caries experience) to reduce the proportion of children aged 6 to 9 with dental caries experience in at least one primary or permanent tooth; the target was set at 49%. Although the age groups do not quite match with the BSS-based grade levels screened, this does provide the basis for a Missouri-specific goal to reduce decay experience among grade school children.

Decay experience among third graders show a decrease since 2013. However, increase is noted starting from 2015 and a slight increase occurred between 2017-2018 and 2018-2019 school years.

Figure 9. Decay Experience among Third Grade Students, 2013-2019



Untreated Decay

The percentage of students with untreated decay is very similar among PSP and BSS participants. The *Healthy People 2020* national objective that relates to untreated decay is to reduce the proportion of children aged 6 to 9 with untreated decay in at least one primary or permanent tooth; the target was set at 25.9%. This is lower compared with the percentage observed by both BSS and PSP participants. This has also been achieved nationally; the untreated decay rate for this age group nationwide was 15.3%.

Figure 10. Untreated Decay among Third Grade Students, BSS 2019 vs PSP 2018-2019

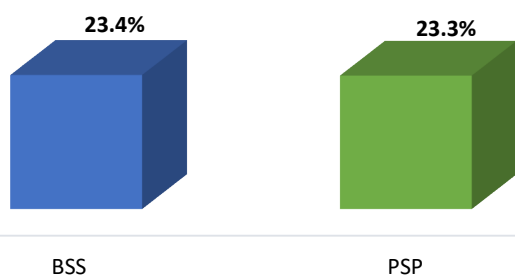
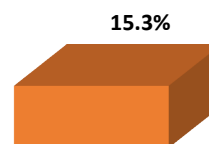
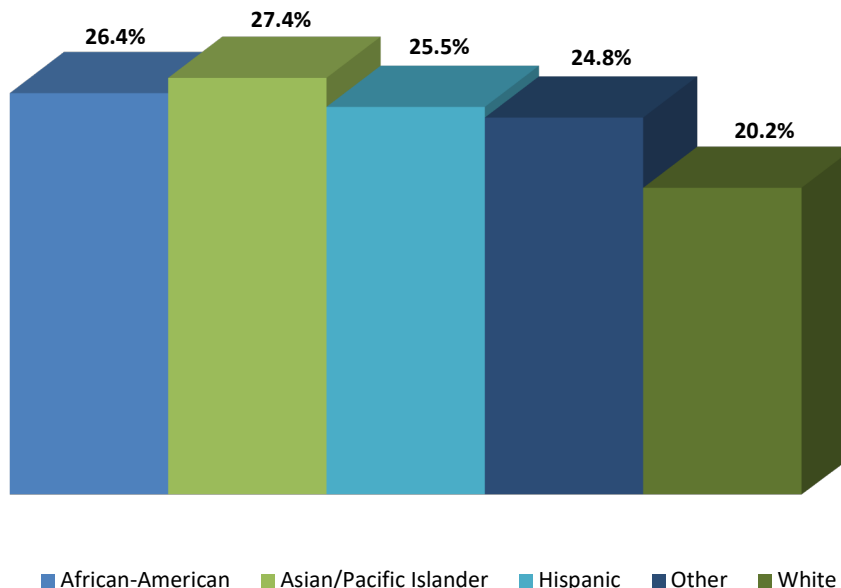


Figure 11. Untreated Decay, National 2015-2016



When untreated decay is examined by race and ethnicity for the whole PSP population (not just third graders), the highest percentage was observed among Asian/Pacific Islander children.

Figure 12. Untreated Decay (Any Tooth) - All Grades by Race and Ethnicity, 2018-2019 PSP



Urgent Dental Treatment Needed

Within PSP, parents or guardians are notified when a dental issue is identified that needs to be addressed. PSP organizers provide referrals to local dental offices or clinics that may be utilized for follow-up care. The need for treatment is categorized in two ways. Early dental care is recommended for injuries or conditions that require the attention of a dental professional in a few months' time. Urgent dental care is recommended to take place within 24 hours because the injury or condition needs immediate attention.

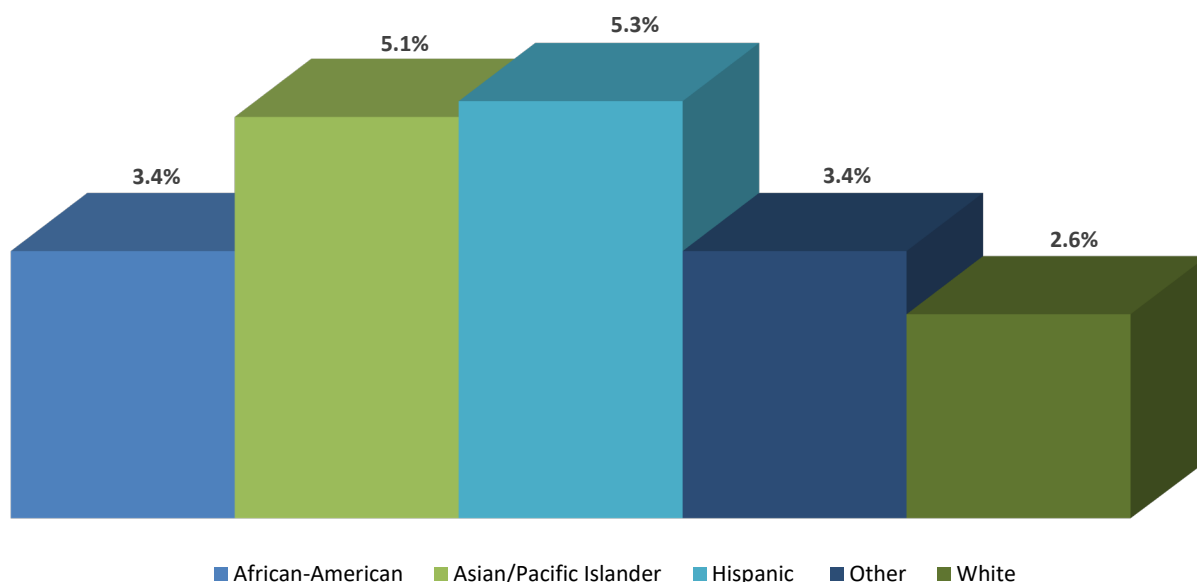
Urgent treatment needs were also recorded on the 2019 BSS. A slightly smaller percentage of third graders in the PSP were identified as having urgent dental needs than the BSS group. There is no national data available for comparison on this variable.

Figure 13. Urgent Dental Treatment Needed among Third Grade Students, BSS 2019 vs PSP 2018-2019



As was seen in the grade categories examined above, overall, the majority of the children screened in the 2018-2019 school year for PSP did not have an urgent dental need, however, this was observed more frequently among Asian/Pacific Islanders and Hispanics than Whites or African-Americans.

Figure 14. Urgent Dental Treatment Needed - All Grades by Race and Ethnicity, PSP 2018-2019



Nutrition

The YRBS collects data on a variety of health-related behaviors among high school students (ninth through twelfth grades). The table below displays findings related to diet and nutrition for Missouri participants in 2019. Students were asked to report dietary behaviors they engaged in over the last week. About 7% of high school students did not eat fruits and drink fruit juices in the past seven days. About 22% of the students drank at least one soda or pop (defined as one can, bottle, or glass) per day and only about 12% had two or more sodas per day. Survey questions in 2019 did not include sport drinks or other sweetened beverages.

Table 6. High School Students - Percent that Reported Selected Dietary Behaviors in the Last Week, Missouri 2019	
Did not eat fruit or drink 100% fruit juices	7.3%
Did not eat vegetables (does not include potatoes)	6.5%
Did not drink milk	26.0%
Drank soda or pop one or more times per day	21.6%
Drank soda or pop two or more times per day	12.2%
Did not eat breakfast	15.4%

Data Source: Missouri Youth Risk Behavior Survey

Cleft Lip and Palate

Cleft lip and cleft palate are birth defects called “orofacial clefts” that occur when a baby’s lip or mouth do not form properly. Individuals may have a cleft lip, a cleft palate or both. Cleft lip and cleft palate are among the most common birth defects in the United States. According to national statistics, one in 33 babies are born with a birth defect (about 3%).²⁰ In Missouri; the rate of morbidity for birth defects per 10,000 births was 706.3 between 2012 and 2016.

The table below shows that between 2011 and 2016, 284 cases of cleft palate and 462 cleft lip cases with or without cleft palate were reported among resident live births in Missouri.

During the time period examined, 2,542 infants were identified with anomalies of the skull and face bones; however, no national data were located on this group of anomalies for comparison.

Table 7. Selected Missouri Resident Birth Defects and Craniofacial Anomalies: Counts and Rates per 10,000 Resident Live Births, 2011-2016		
	Defects	Rate per 10,000 Live Births
Cleft palate only	284	6.3
Cleft lip (with or without cleft palate)	462	10.2
Anomalies of skull and face bones	2,542	56.3

In general, women of childbearing age should be aware of recommendations to prevent birth defects, such as taking the recommended daily dose of folic acid and avoiding smoking and drinking during pregnancy. Specifically, research has shown that smoking during pregnancy and having diabetes before pregnancy each increase the risk of orofacial defects.²¹

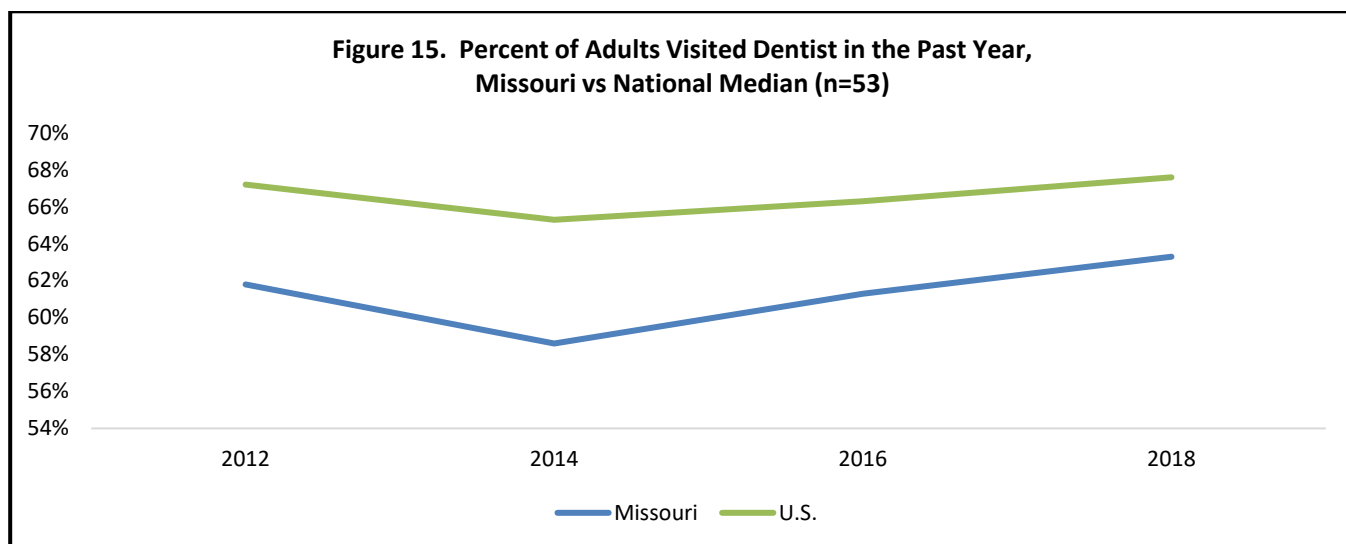
The long-term consequences of orofacial clefts may include ear infections, hearing loss, problems with teeth and difficulty feeding and talking. Beginning in early childhood, children with these defects often need surgery and ongoing services and treatment such as speech therapy and special dental and orthodontic care.²⁰

Adults

Oral Health questions are asked every other year on the BRFSS. Trend data are reported in compliance with CDC recommendations. National data were obtained using the median for all 50 states plus District of Columbia and two territories (n=53).⁶

Dental Visits

The recommendation for frequency of dental visits varies among individuals, however most healthy adults should visit a dentist at least once per year. During this visit, a dentist or dental hygienist will examine the teeth and gums, look for broken or damaged teeth, and will look for signs of oral cancer. Additionally, teeth will be cleaned to remove plaque and calculus/tartar in order to prevent tooth decay. Dental professionals often educate patients about proper brushing and flossing techniques, good dietary practices, avoiding tobacco products and ways to avoid injuring teeth and gums.²²



Data Source: National BRFSS Site

Among adults, Missouri residents reported visiting a dentist in the last year at a lower percentage than was observed nationwide each year, including 2018. In 2018, about 63% of Missouri adults visited a dentist in the last year compared to about 67% nationally.⁶

Table 8. Percent of Adults - Visited a Dentist in the Last Year, Missouri vs National Median (n=53), 2018

Missouri	63.3%
National Median	67.3%

Data Source: National BRFSS Site

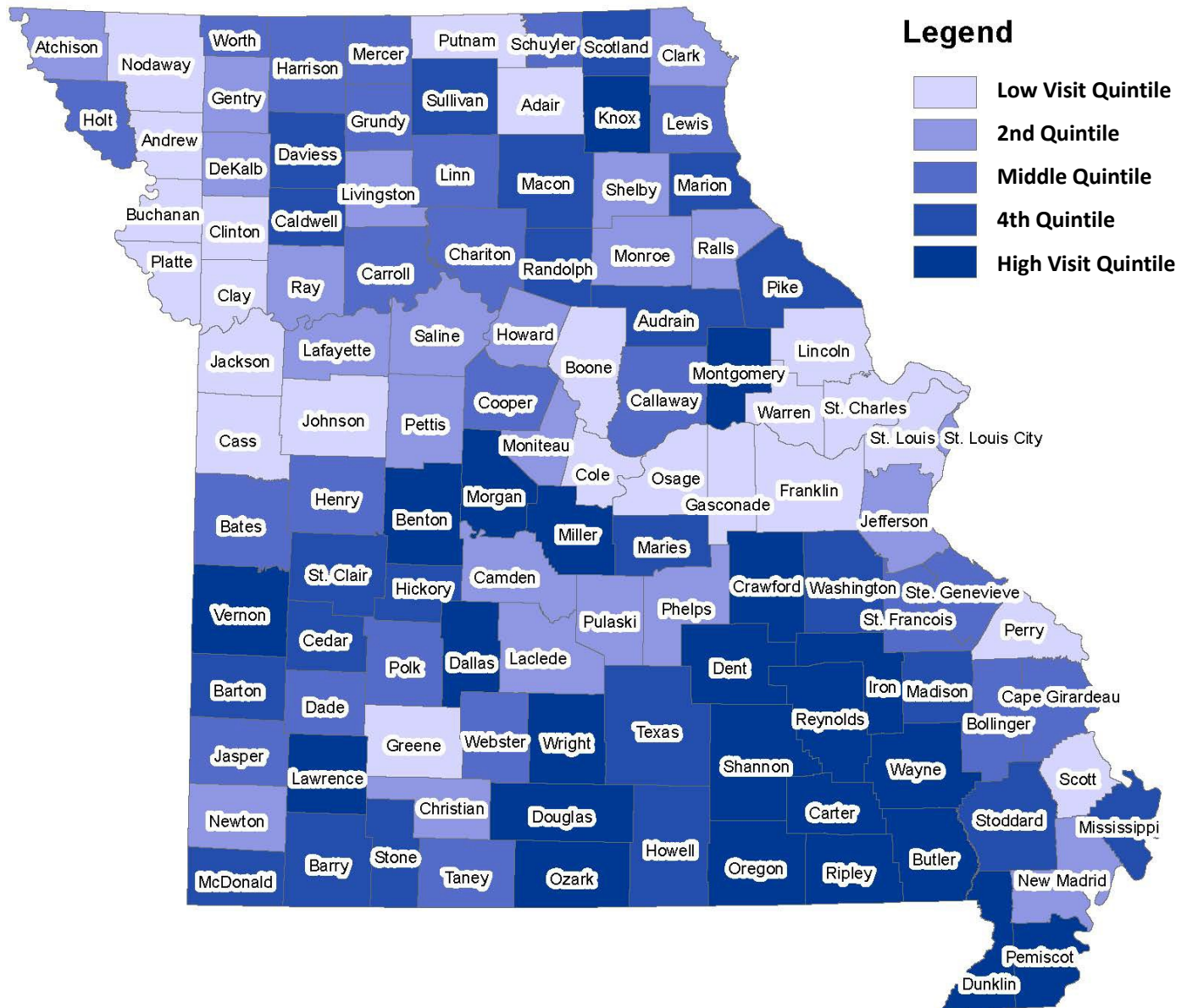
According to the Missouri 2018 BRFSS, the percentage of females that visited a dentist in the last year was higher than among males. When examined by race and ethnicity, African-American and Hispanic adults reported visiting a dentist less frequently than other groups. Higher percentages were observed as both annual income and educational attainment increased.

Table 9. Percent of Adults - Visited a Dentist in the Last Year, 2018	
Overall	63.3%
Sex	
Female	64.4%
Male	62.1%
Age Group	
18 to 24 Years Old	70.0%
25 to 34 Years Old	62.3%
35 to 44 Years Old	63.9%
45 to 54 Years Old	62.2%
55 to 64 Years Old	64.5%
65 Years and Older	59.9%
Race	
African-American	59.8%
Hispanic	53.6%
White	64.4%
Education	
Less than High School	37.7%
High School or G.E.D.	58.2%
Some Post-High School	64.4%
College Graduate	78.8%
Annual Income	
Less than \$15,000	36.5%
\$15,000 - \$24,999	43.9%
\$25,000 - \$34,999	54.8%
\$35,000 - \$49,999	63.8%
\$50,000+	75.6%

Source: Missouri 2018 BRFSS

Figure 16.

2016 Dental Visit in the Past Two Years



DHSS-MOPHIMS Community Data Profiles- Health and Preventive Practices

Office: Office of Dental Health
Initial: MG
Date Printed: February 2020

As shown in the figure above, quintile is simply one-fifth of a ranked list. The quintiles are determined by ranking counties in order by rate of dental visits in the past two years. The first quintile represents the preferred health outcome rates.

Tooth Loss

Adults on the BRFSS every other year between 2012-2018 were asked, “How many of your permanent teeth have been removed because of tooth decay or gum disease?” For every year, the percent of adults with at least one permanent tooth extracted due to decay was higher among Missouri residents than was observed for the nation as a whole, including for 2019.⁶

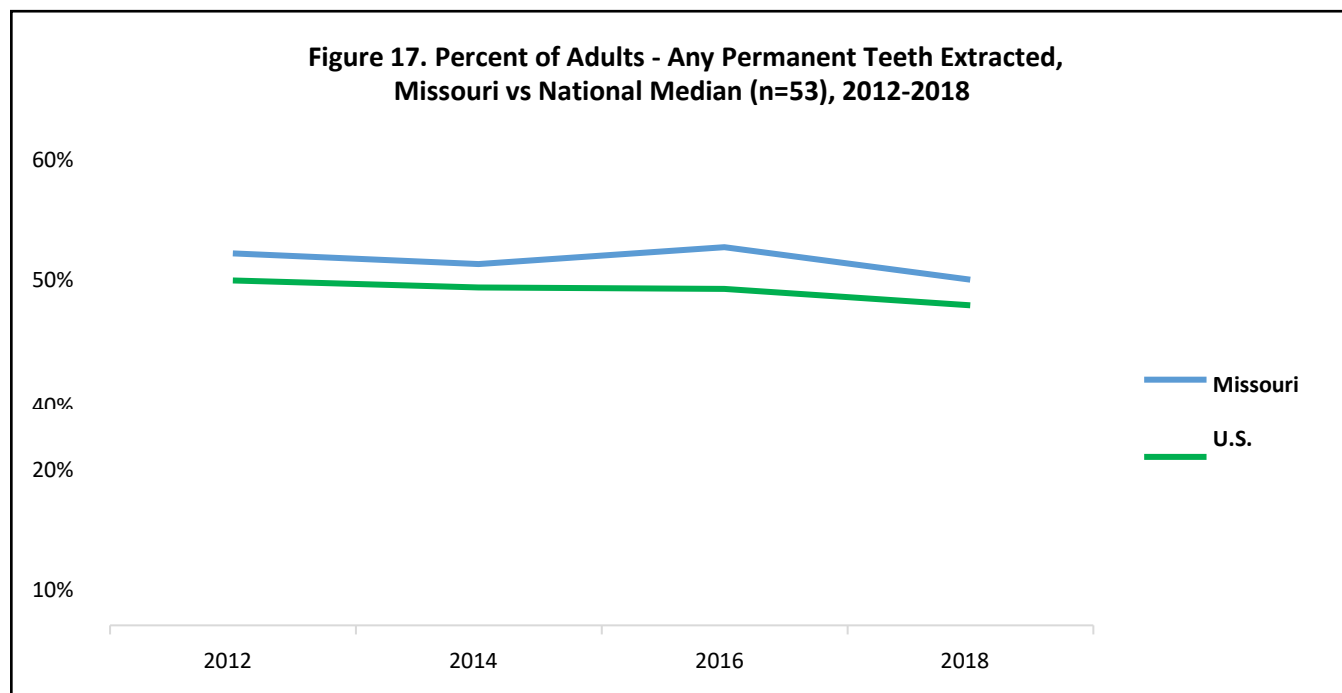


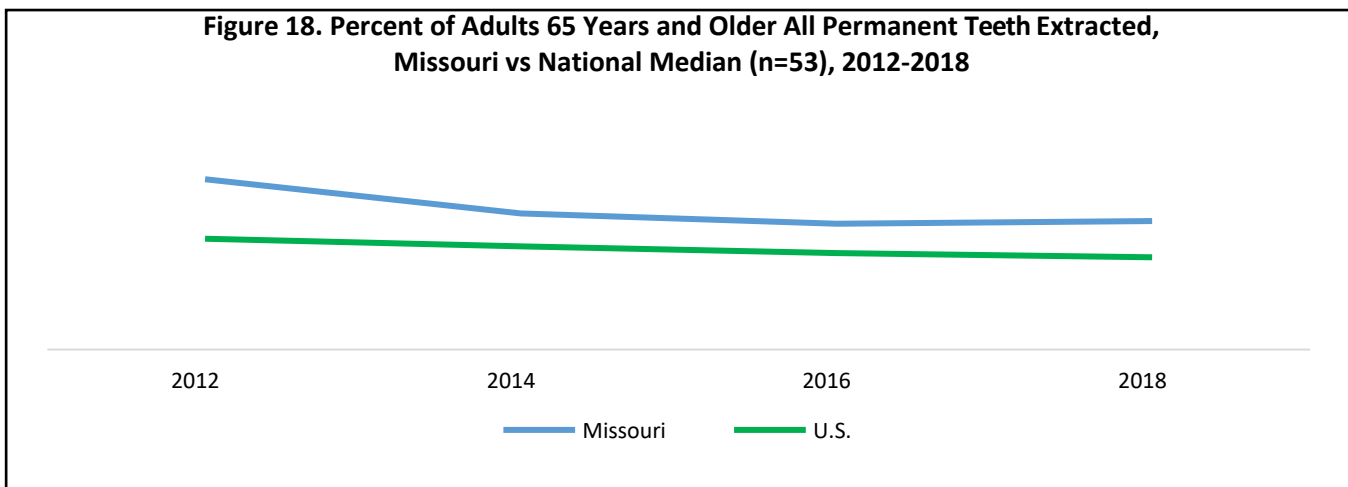
Table 10. Percent of Adults - Any Permanent Teeth Extracted, Missouri vs National Median (n=53), 2018

Missouri	44.6%
National Median	41.3%

About 45% of Missouri adults had at least one permanent tooth extracted due to decay or gum disease according to the 2018 data. This percentage is slightly higher among females than males. The percentage increased with age, with the highest percentage observed among individuals aged 65 and older. The percentage was higher among African-Americans than other racial or ethnic groups. Lower income and educational attainment levels were also associated with higher percentages of tooth loss.

Table 11. Percent of Adults - Any Permanent Teeth Extracted - Missouri, 2018	
Overall	44.6%
Sex	
Female	45.2%
Male	44.1%
Age Group	
18 to 24 Years Old	13.4%
25 to 34 Years Old	27.6%
35 to 44 Years Old	39.4%
45 to 54 Years Old	45.4%
55 to 64 Years Old	56.5%
65 Years and Older	70.6%
Race	
African-American	50.6%
Other	39.2%
White	39.2%
Ethnicity	
Hispanic	37.0%
Education	
Less than High School	64.1%
High School or G.E.D.	53.1%
Some Post-High School	42.7%
College Graduate	29.0%
Annual Income	
Less than \$15,000	62.1%
\$15,000 - \$24,999	60.4%
\$25,000 - \$34,999	55.8%
\$35,000 - \$49,999	46.8%
\$50,000+	33.6%

Data Source: Missouri 2018 BRFSS Report



Data Source: National BRFSS Site 2018

When tooth loss is examined for individuals 65 years and older, Missouri has had higher percentages than is observed nationwide (n=53) in every year examined. Missouri and national data are available every other year between 2012 and 2018.

Table 12. Percent of Adults 65 Years and Older - All Permanent Teeth Extracted, Missouri vs National Median (n=53), 2018	
Missouri	18.8%
National Median	13.5%

Data Source: National BRFSS Site 2018

Among Missourians, aged 65 years and older, higher percentage of females had all their permanent teeth extracted due to decay or gum disease compared with males. When comparing by age group, higher percentages were observed among those 75 years and older than those 65 to 74 years old. Whites had lower rates than African-American; insufficient numbers in this age group were available for other races or Hispanics. Individuals with higher educational attainment and annual income had lower percentages of complete tooth loss.

Table 13. Percent of Adults - All Permanent Teeth Extracted - Missouri, 2018	
Overall	18.8%
Sex	
Female	25.0%
Male	21.5%
Age Group	
65 to 74 Years Old	15.7%
75 Years and Older	23.1%
Race	
African-American	27.0%
Other	N/A
White	18.6%
Education	
Less than High School	40.8%
High School or G.E.D.	22.3%
Some Post-High School	14.1%
College Graduate	4.0%
Annual Income	
Less than \$15,000	42.2%
\$15,000 - \$24,999	34.4%
\$25,000 - \$34,999	16.3%
\$35,000 - \$49,999	8.9%
\$50,000+	8.1%

Data Source: Missouri 2018 BRFSS Report

A *Healthy People 2020* objective has been established for adults 65 to 74 years old, to reduce the proportion of these individuals who had lost all of their natural teeth to 21.6%.¹⁹ Currently for Missouri, this proportion is around 23.1%. This information may be useful if interventions targeting oral health among older adults are implemented in Missouri either locally or statewide.

Linkages have been made between poor oral health outcomes such as tooth decay and periodontal disease and a variety of chronic health conditions.²³ According to data collected by the BRFSS in 2018, a higher percentage of Missouri adults reported they had been told by a doctor that they had five major chronic health indicators associated with poor oral health than was reported nationwide.⁵

Table 14. Percentage of Population Affected by Selected Chronic Health Indicators, Missouri vs National Median (n=53), 2018		
Indicator	Missouri	National Median
Heart Attack/Myocardial Infarction	5.1%	4.6%
Angina/Coronary Heart Disease	5.1%	4.3%
Stroke	4.2%	3.4%
Arthritis	31.1%	26.1%
Diabetes (not including gestational or pre-diabetes)	11.5%	9.7%

Data Source: National BRFSS Site 2018

Tobacco Use and Risk

The use of cigarettes, vapor products and smokeless or chewing tobacco is a risk factor for periodontal disease, dental caries and other oral diseases. Additionally, current smokers report poorer oral health status and more oral health problems than either former smokers or those who never smoked.²⁴

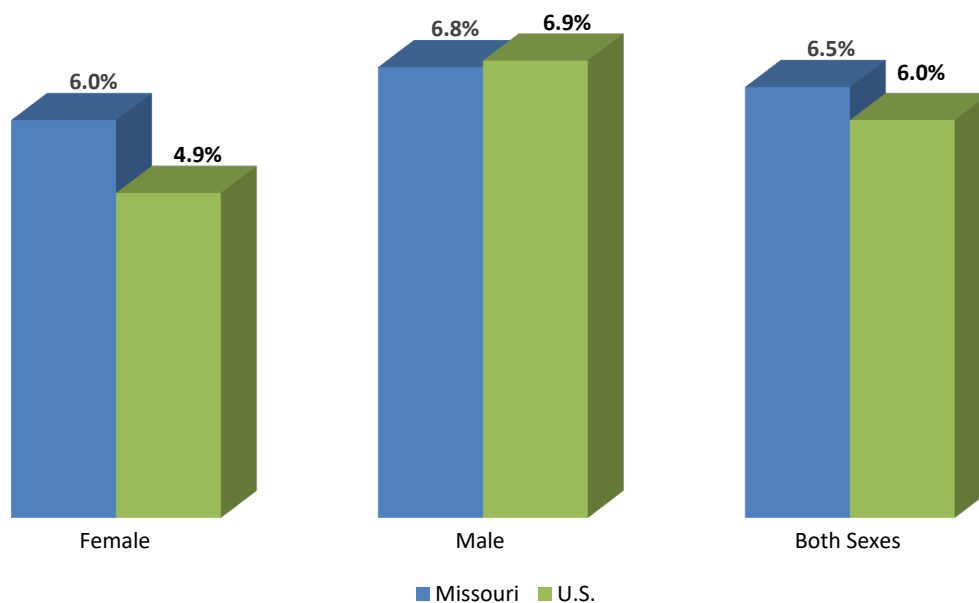
Most urgently, however, tobacco use has been linked to oral lesions that can develop into cancer of the oral cavity and pharynx. Tobacco use has been estimated to account for 90% of all oral cancers and has been identified as the greatest preventable risk factor for oral cancer. Cancer of the oral cavity and pharynx are among the most deadly cancers; only about half of all individuals with oral cancer are still alive five years after diagnosis.²

The use of tobacco products can be examined in both young people and adults. While oral cancer is typically diagnosed in adulthood, a national study demonstrated that nearly 20% of children 12 to 17 years of age who currently use chewing tobacco had the type of oral lesion linked with tobacco use. Prevalence of this lesion increased with increasing duration and frequency of chewing tobacco use.²

Tobacco Use – High School Students

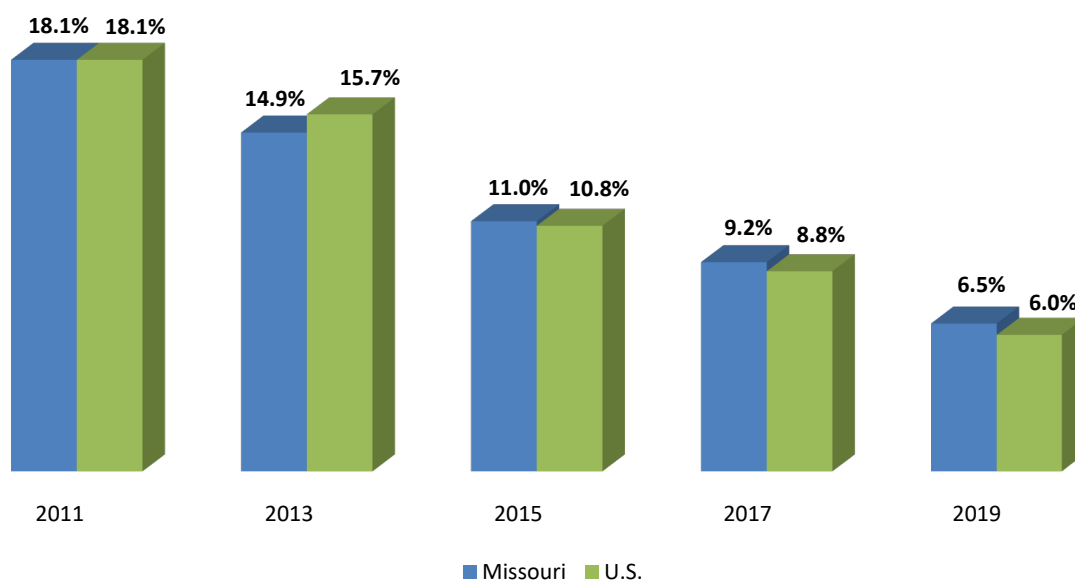
The YRBS asked high school students about tobacco use. In both Missouri and nationwide, approximately less than 10 percent of all students had smoked cigarettes on at least one day in the last 30 days. Identified in the survey as “current cigarette user.” This percentage was higher among males than females in both Missouri and nationwide.⁶

Figure 19. High School Students - Current Cigarette Use, Missouri vs Nationwide, 2019



Data Source: Youth Risk Behavior Survey

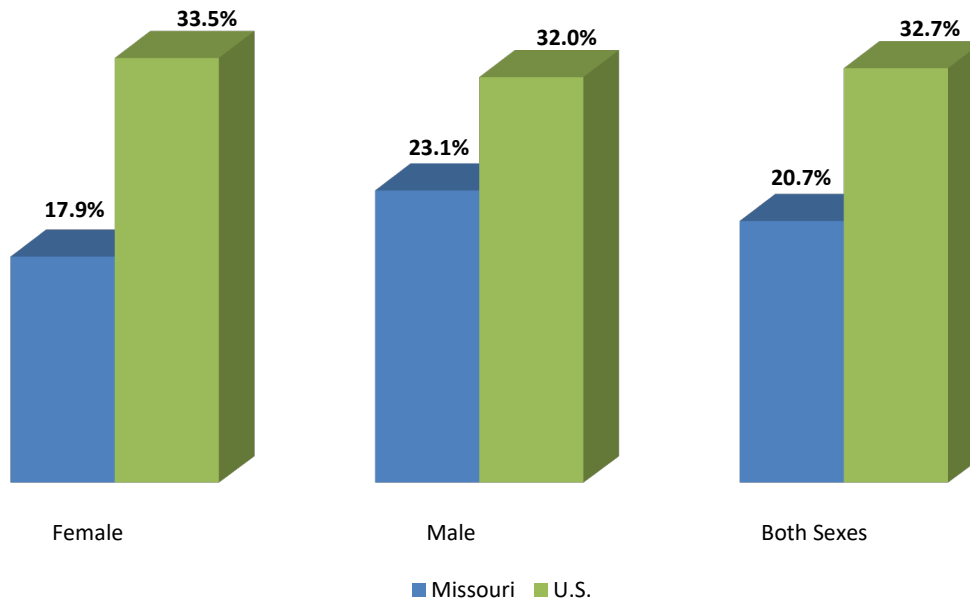
Figure 20. High School Students - Current Cigarette Smoking, Missouri vs Nationwide, 2011-2019



Data Source: Youth Risk Behavior Survey

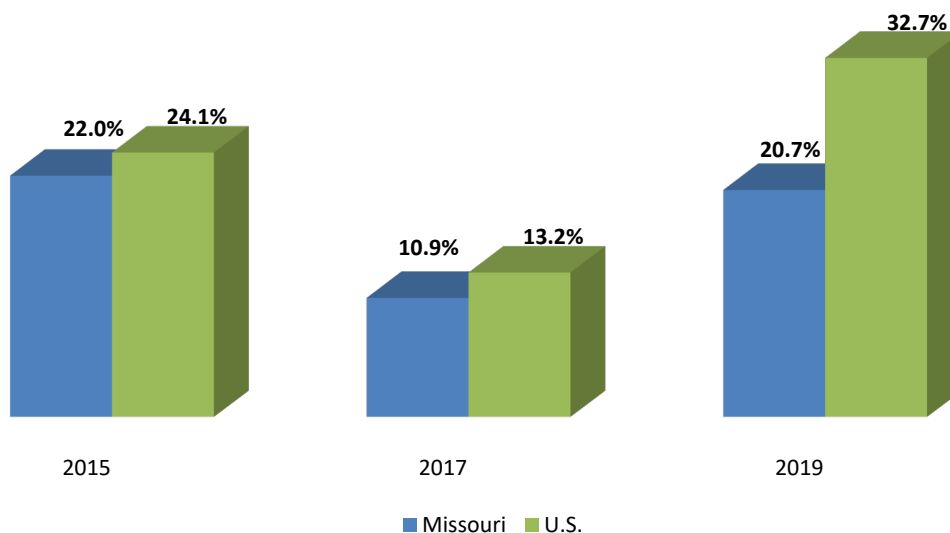
Based on the use of electronic vapor products on at least one day in the last 30 days, about 20.7% of Missouri high school students were identified as current electronic vapor product users, which is lower than the national percentage of 32.7%. The percentages were higher among males than females (about 21% versus 18%) among Missouri high school students; the gap was lower and reversed with what was observed nationally (33.5% female usage verses 32.0% male usage).

Figure 21. High School Students - Current Electronic Vapor Product Use, Missouri vs Nationwide, 2019



Data Source: Youth Risk Behavior Survey

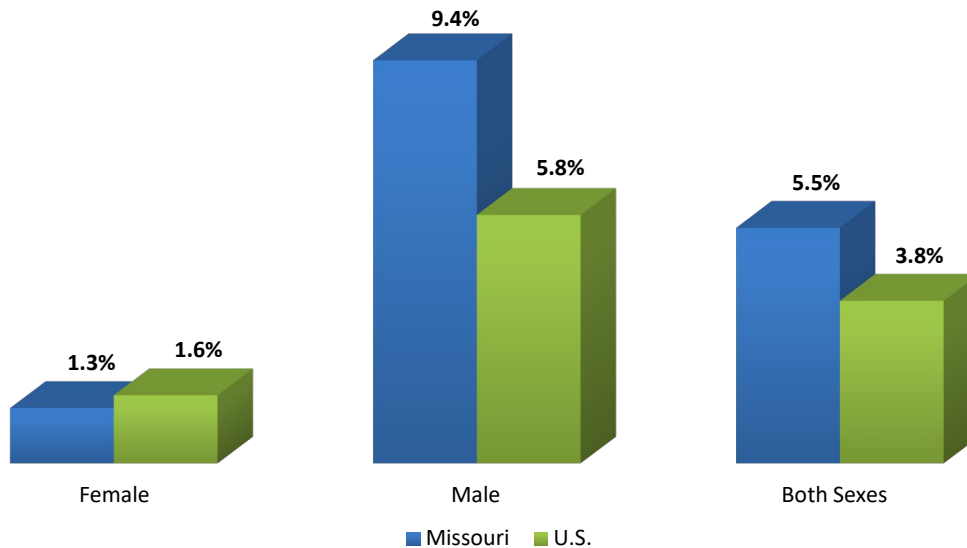
Figure 22. High School Students - Current Electronic Vapor Product Use, Missouri vs Nationwide, 2015-2019



Data Source: Youth Risk Behavior Survey

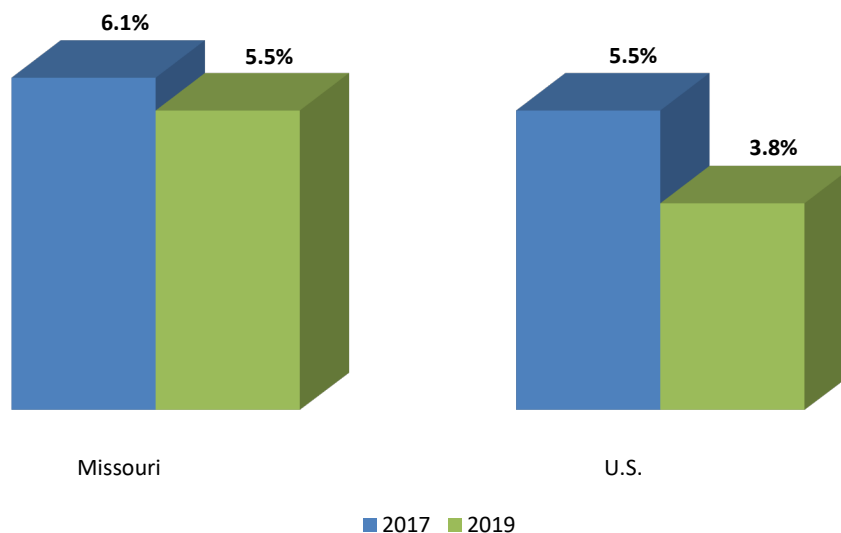
Based on the use of chewing tobacco on at least one day in the last 30 days, about 5.5% of Missouri high school students were identified as current chewing tobacco users, which is higher than the national percentage of 3.8%. The percentages were much higher among males than females (about 9% versus 1%) among Missouri high school students; the gap is even higher with what was observed nationally (about 6% versus 2%).

Figure 23. High School Students - Current Smokeless Tobacco Use, Missouri vs Nationwide, 2019



Data Source: Youth Risk Behavior Survey

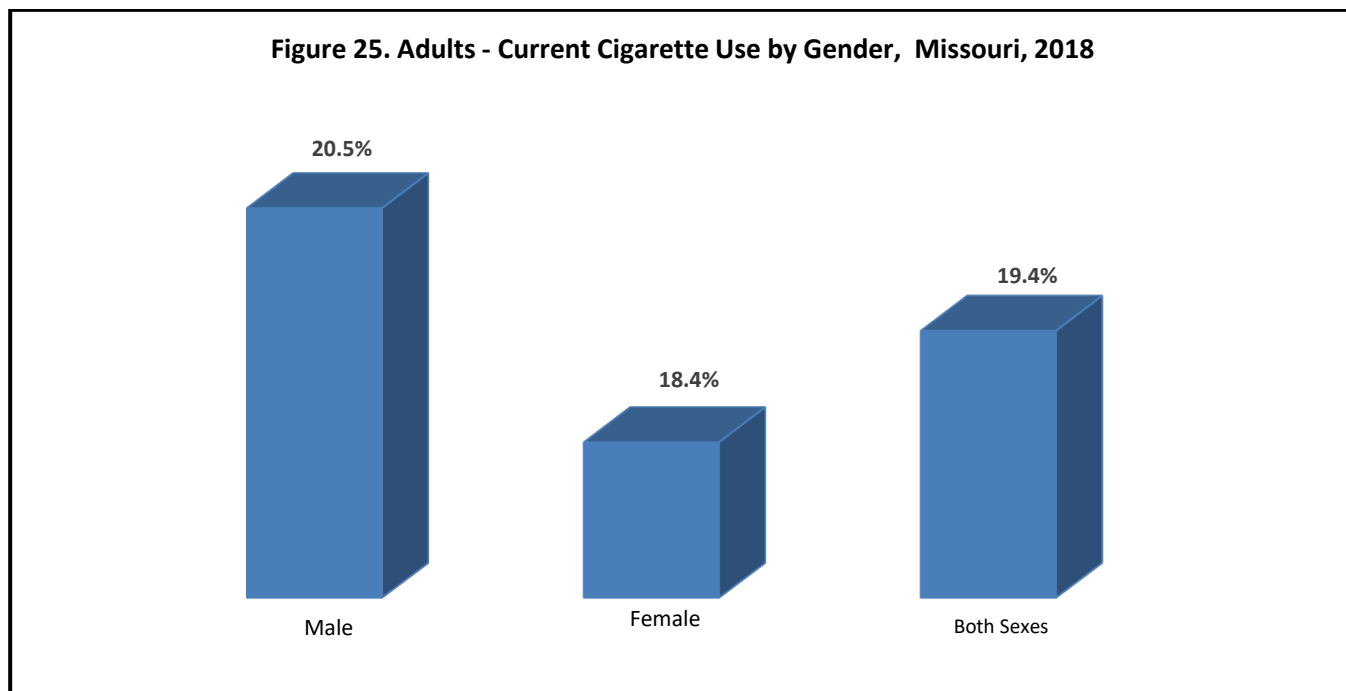
Figure 24. High Schools Students - Current Smokeless Tobacco Use, Missouri vs Nationwide, 2017-2019



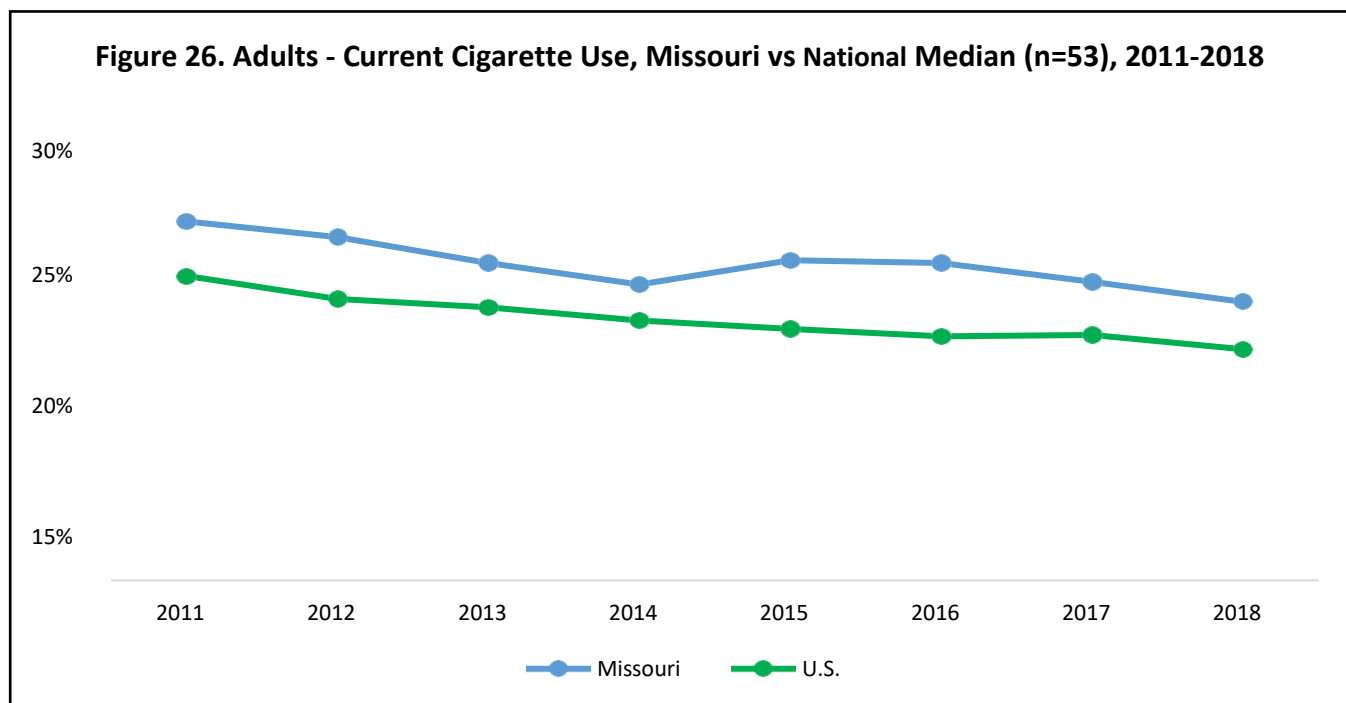
Data Source: Youth Risk Behavior Survey

Tobacco Use – Adults

According to the 2018 BRFSS, about 19% of Missouri adults currently use cigarettes, which is slightly higher than was observed nationally (about 16%). In Missouri, a greater percentage of males currently smoke than females. Nationwide gender data is not available for current tobacco use. All BRFSS rates reported in this section are age-adjusted.



Data Source: National BRFSS Site



Data Source: National BRFSS Site

Table 15. Current Cigarette Use by Race and Ethnicity, Adults 18 Years and Older, Missouri, 2018

African-American	22.1%
White	18.9%

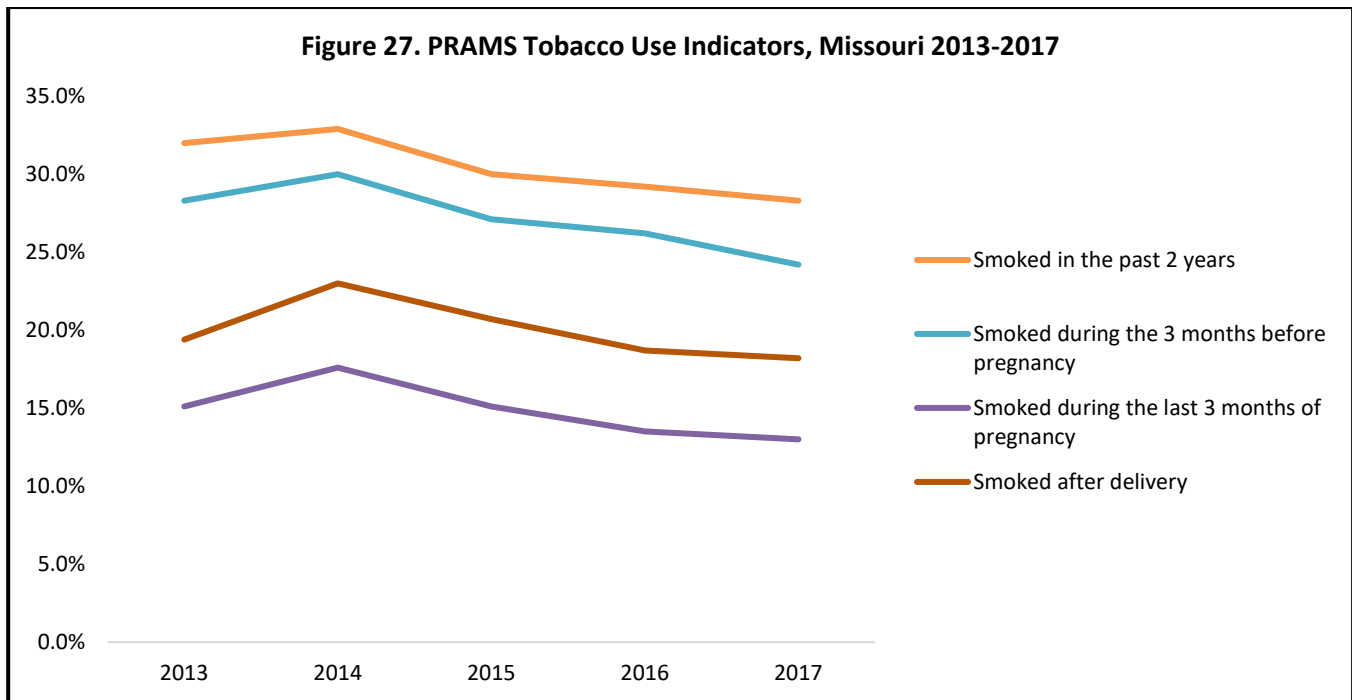
Data Source: national BRFSS Site

Among Missouri adults, about 5.6% currently use smokeless (chewing) tobacco. However, use of this kind of tobacco is rare among females (<1%) so it is most useful to look at the prevalence among males, which is 10.6%.

Tobacco Use – Pregnant Women

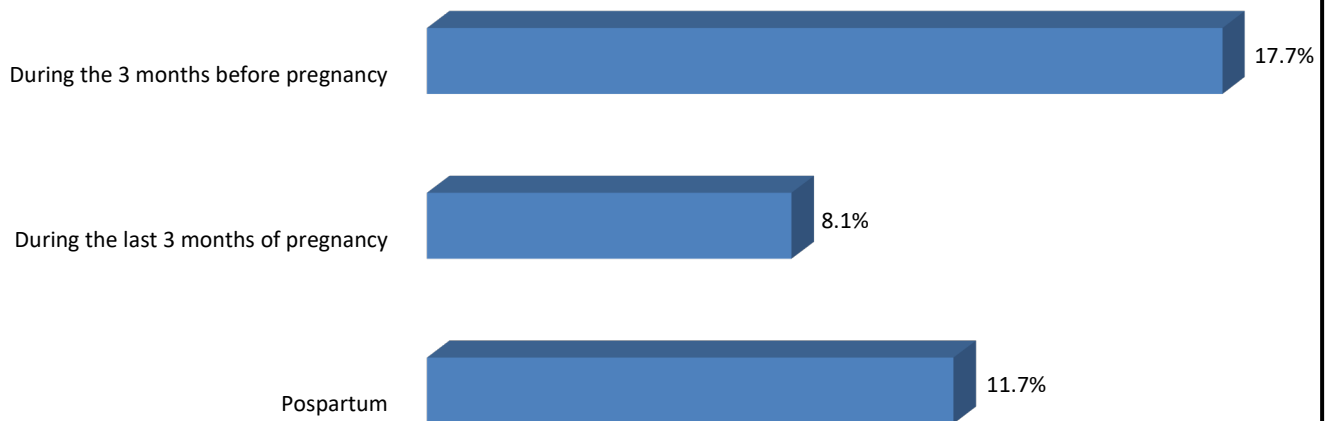
According to CDC, smoking while pregnant increases the risk of health problems for developing babies, including preterm birth, low birth weight and birth defects of the mouth and lip. It also increases the risk of Sudden Infant Death Syndrome (SIDS). Hormonal changes while pregnant can make gums more vulnerable to plaque, leading to inflammation and bleeding, called pregnancy gingivitis.

In 2017, about 24% of pregnant women in Missouri smoked three months before their pregnancy. Nationally, about 18% of women smoked three months before their pregnancy. Starting 2014, the rate women who smoked three months prior to their pregnancy has been declining. A similar trend was also observed in the other tobacco use indicators. About 13% of pregnant women smoked during their last three months of pregnancy compared with 8.1% nationwide. About 18% of the mothers smoked after delivery while close to 12% smoked after delivering nationwide.



Data Sources: Missouri PRAMS Program

Figure 28. Any Cigarette Smoking Nationwide, 2017



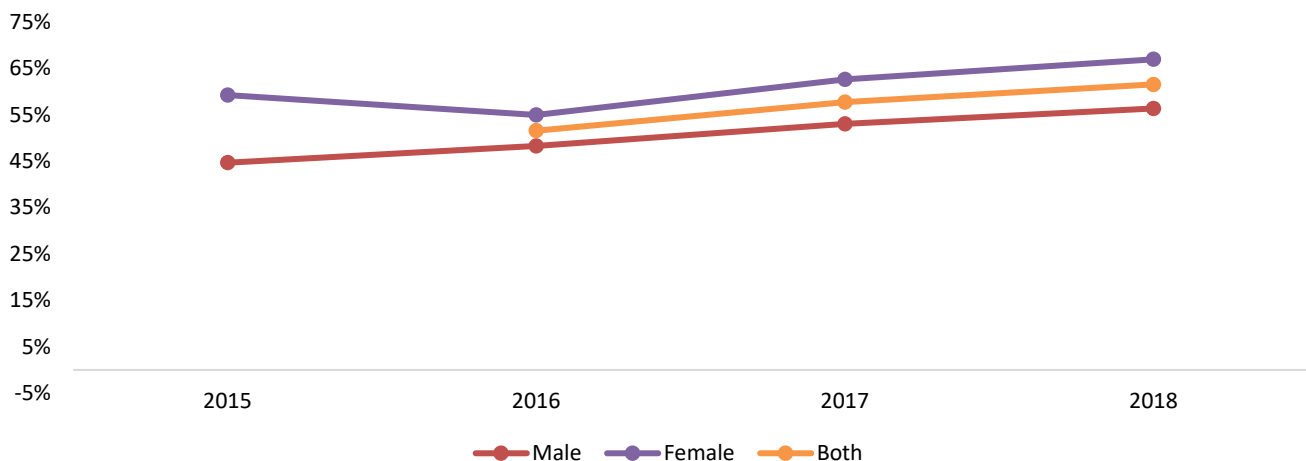
Data Source: CDC PRAMS Site

Cancer Incidence and Mortality

HPV is the most common sexually transmitted disease in the United States. HPV infects the mouth and throat, causing Oropharyngeal cancer. In the United States, HPV is thought to cause 70% of Oropharyngeal cancer. HPV vaccination prevents new HPV infections. HPV vaccine is recommended for routine vaccination for children of age 11 and 12 years old. Vaccination can be administered starting at age 9 years old and through age 26. Two or three doses of HPV vaccine can be administered depending on the child's age and initial vaccination. Children who start the vaccine series on or after they turn 15 need three shots given over six months.²⁵

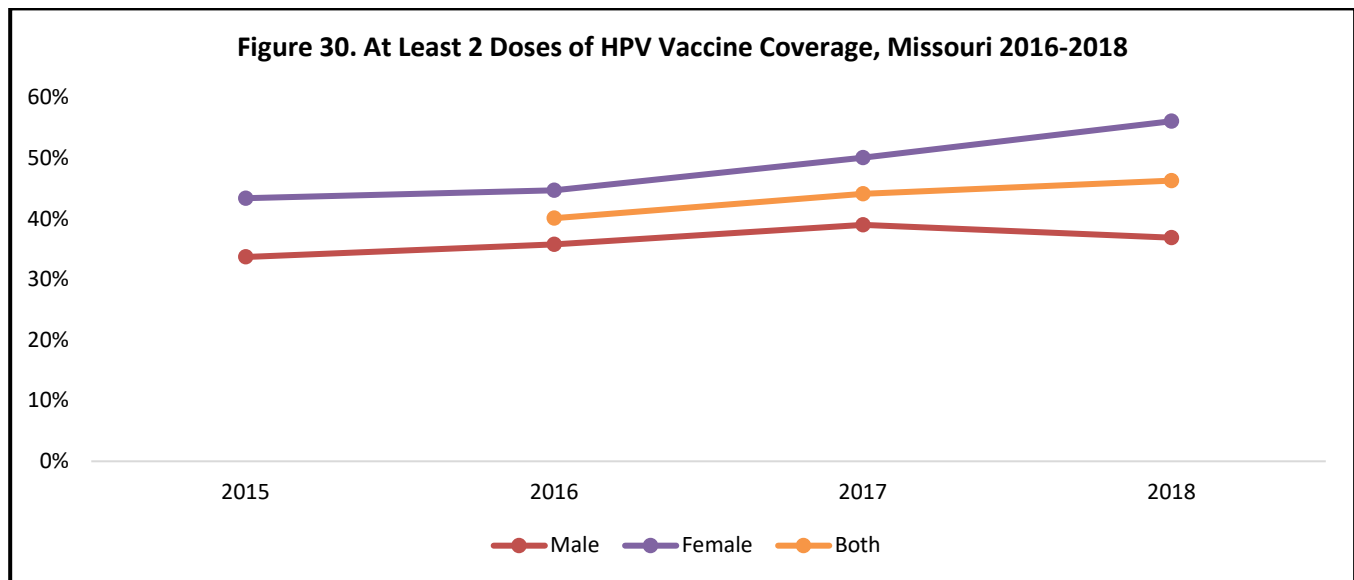
According to CDC's 2018 data, vaccination coverage rate for those receiving at least one dose was higher among females compared with males. Except in 2016, the vaccination rate among females increased in both 2017 and 2018. Nationwide, HPV vaccination rates improved in 2018 compared with 2017 data. The coverage rate for those receiving at least one dose increased from 65.5% to 68.1%.²⁶

Figure 29. At Least 1 Dose of HPV Vaccine Coverage, Missouri 2016-2018



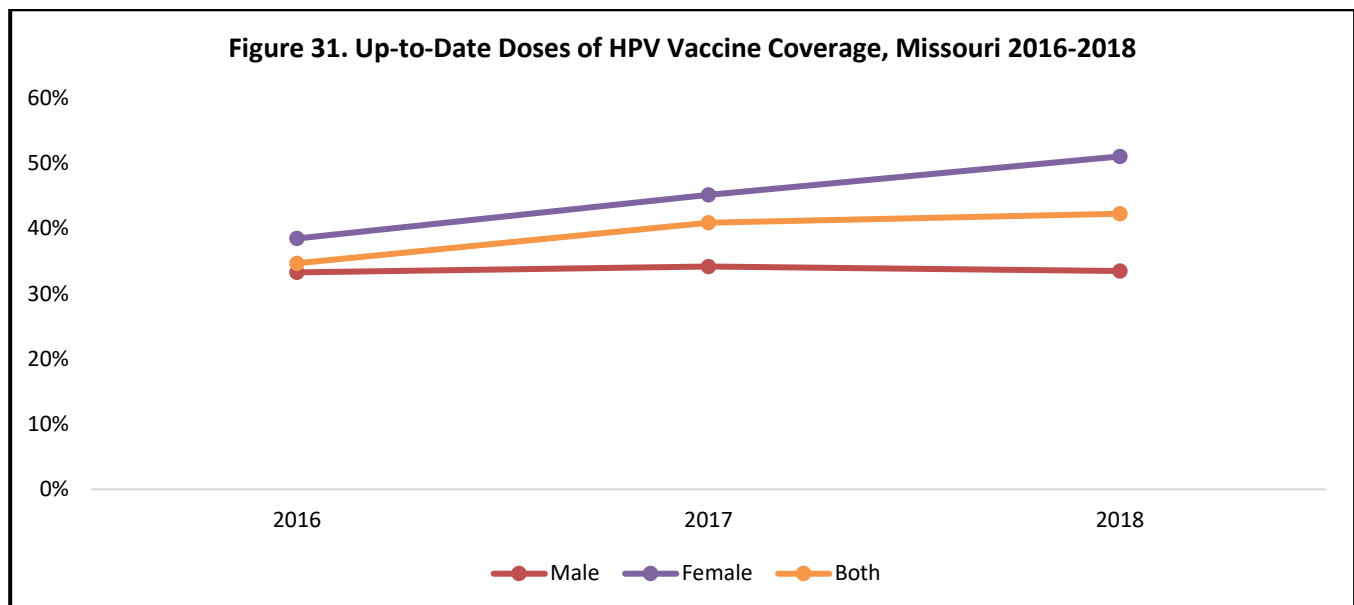
Data Source: CDC TeenVaxView

Vaccination coverage rate for those receiving at least two doses was higher among females compared with males. The vaccination rate among females and overall data increased 2015 through 2018. Among males, HPV vaccination rates were improving between 2015 and 2018. However, a decrease in the rate of vaccine was observed in 2018.



Data Source: CDC TeenVaxView

Vaccination coverage rate for who received up-to-date doses of HPV vaccine showed an increase between 2016 and 2018 among both with women and overall rates. However, there was a slight decrease in 2018 among males who received up-to-date doses.

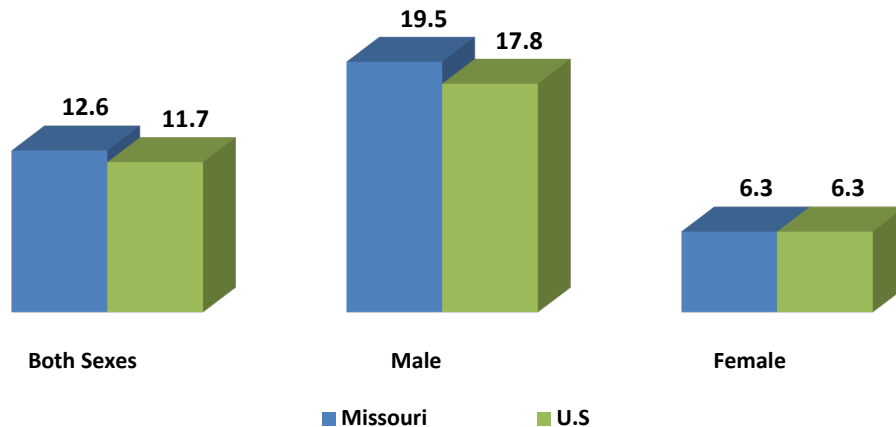


Data Source: CDC TeenVaxView

According to the American Cancer Society, oral cavity and Oropharyngeal cancer mostly occur in areas of the tongue, tonsils and oropharynx as well as the gums, floor of the mouth and other parts of the mouth. Some also are found in the lips and minor salivary glands. About 53,260 people will get oral cavity or Oropharyngeal cancer. Out of those close to 10,750 people will die from oral or Oropharyngeal cancers. In 2016, 953 cases with invasive form of oral cavity and pharynx cancer were report among Missouri residents. Out of the 953, 699 of these (73%) were among males.

The rate for males was significantly higher than for females, both in Missouri and nationwide.²⁶ The incidence rate for 2016 was 12.6 per 100,000 for Missouri, which is slightly higher than the national rate of 11.7. All incidence and death rates for cancer statistics are age-adjusted using 2000 standard population and are reported per 100,000 population. When rates were examined over several years, no significant trend in terms of increasing or decreasing incidence was found.

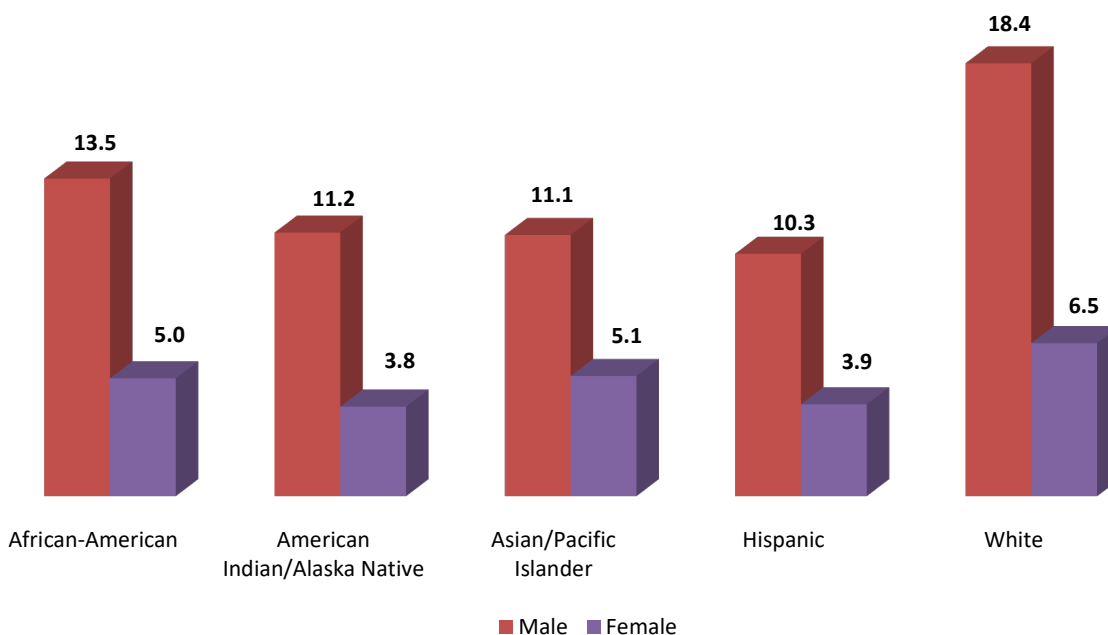
Figure 32. Age-Adjusted Incidence Rate per 100,000 Population by Sex, Oral Cavity and Pharynx Cancer, Missouri 2016



Data Source: United States Cancer Statistics

When United States rates were examined by race and sex, rates were higher for males in each racial and ethnic group than for females. Rates were highest among white males and females.

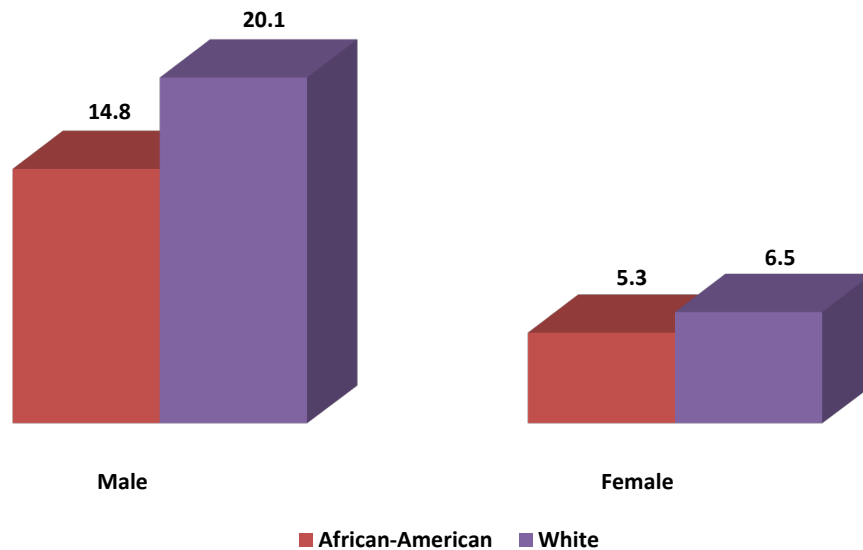
Figure 33. Oral Cavity and Pharynx Cancer Incidence Rate per 100,000 Population, Nationwide - 2016



Data Source: United States Cancer Statistics

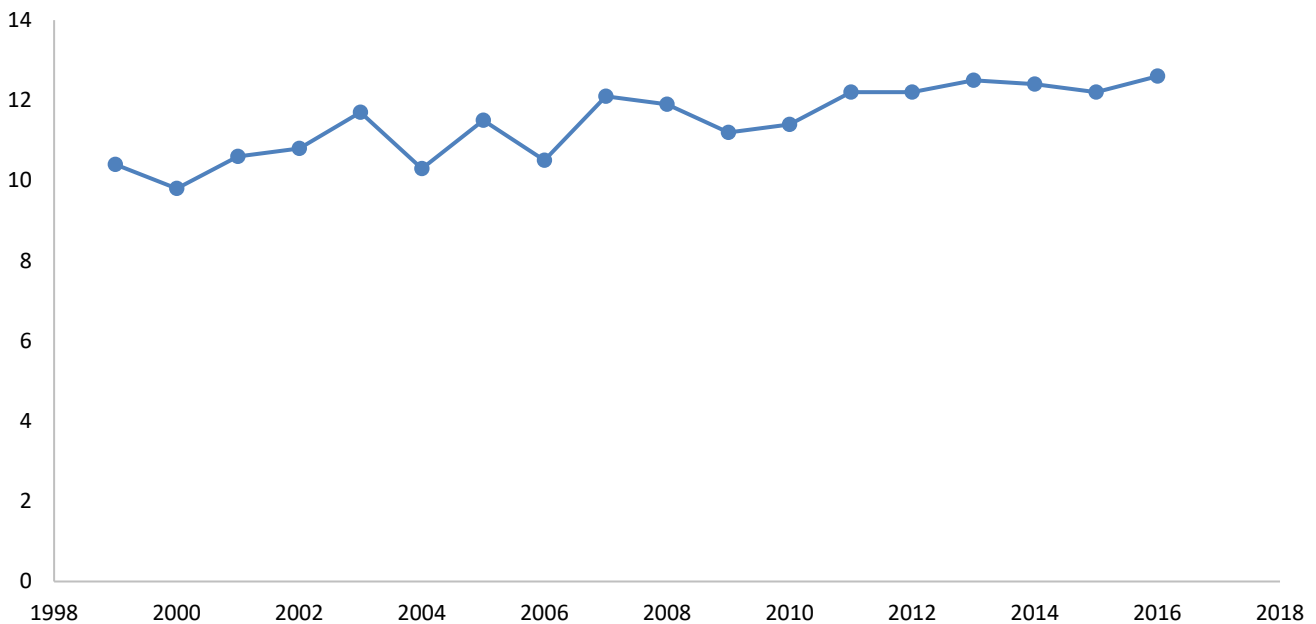
When Missouri rates are examined by race and sex, rates were higher for males than for females.

Figure 34. Age-Adjusted Incidence per 100,000 Population by Race, Oral Cavity and Pharynx Cancer, Invasive Disease, Missouri, 2016



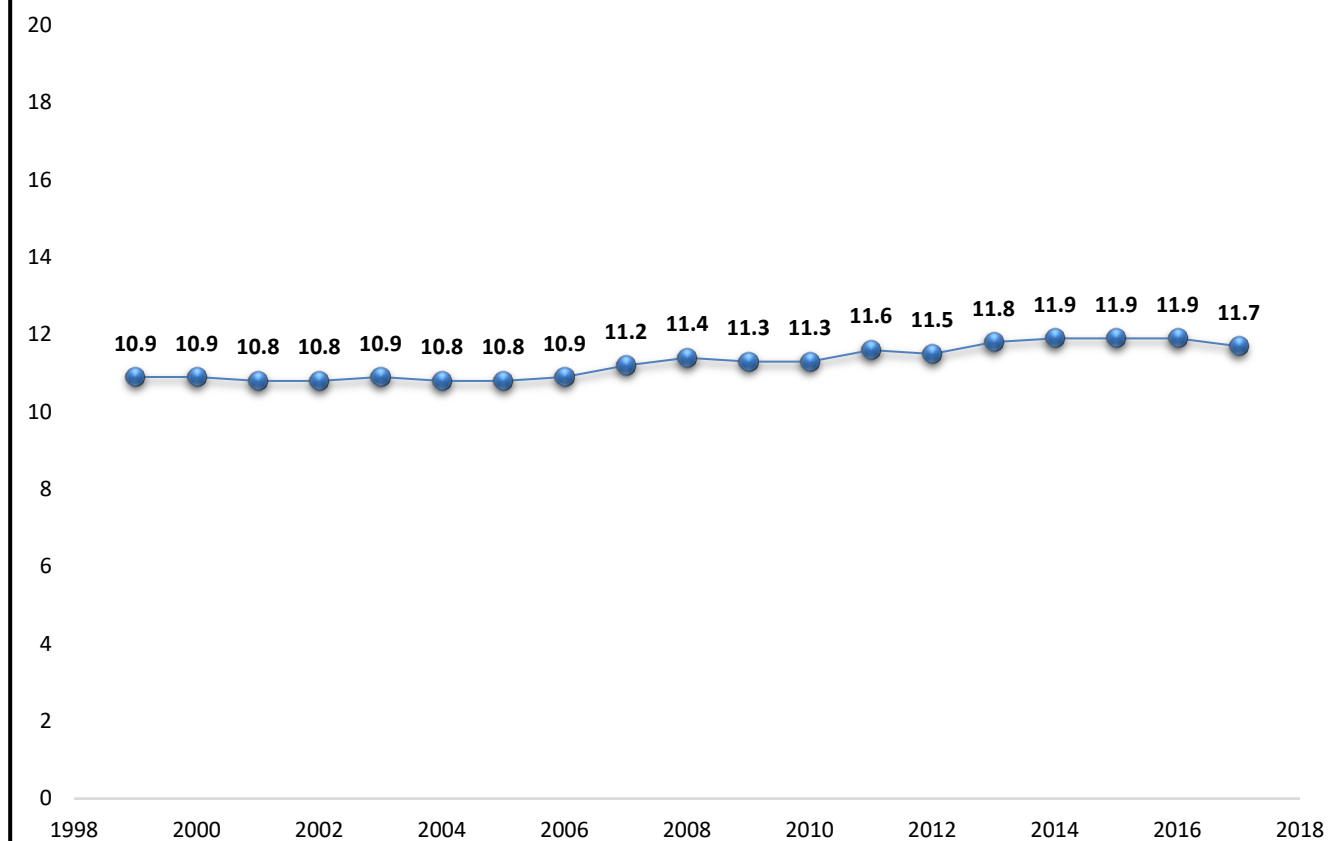
Data Source: United States Cancer Statistics

Figure 35. Oral Cavity and Pharynx Cancer Incidence Rate per 100,000 Population, Missouri 1999-2016



Data Resource: United States Cancer Statistics

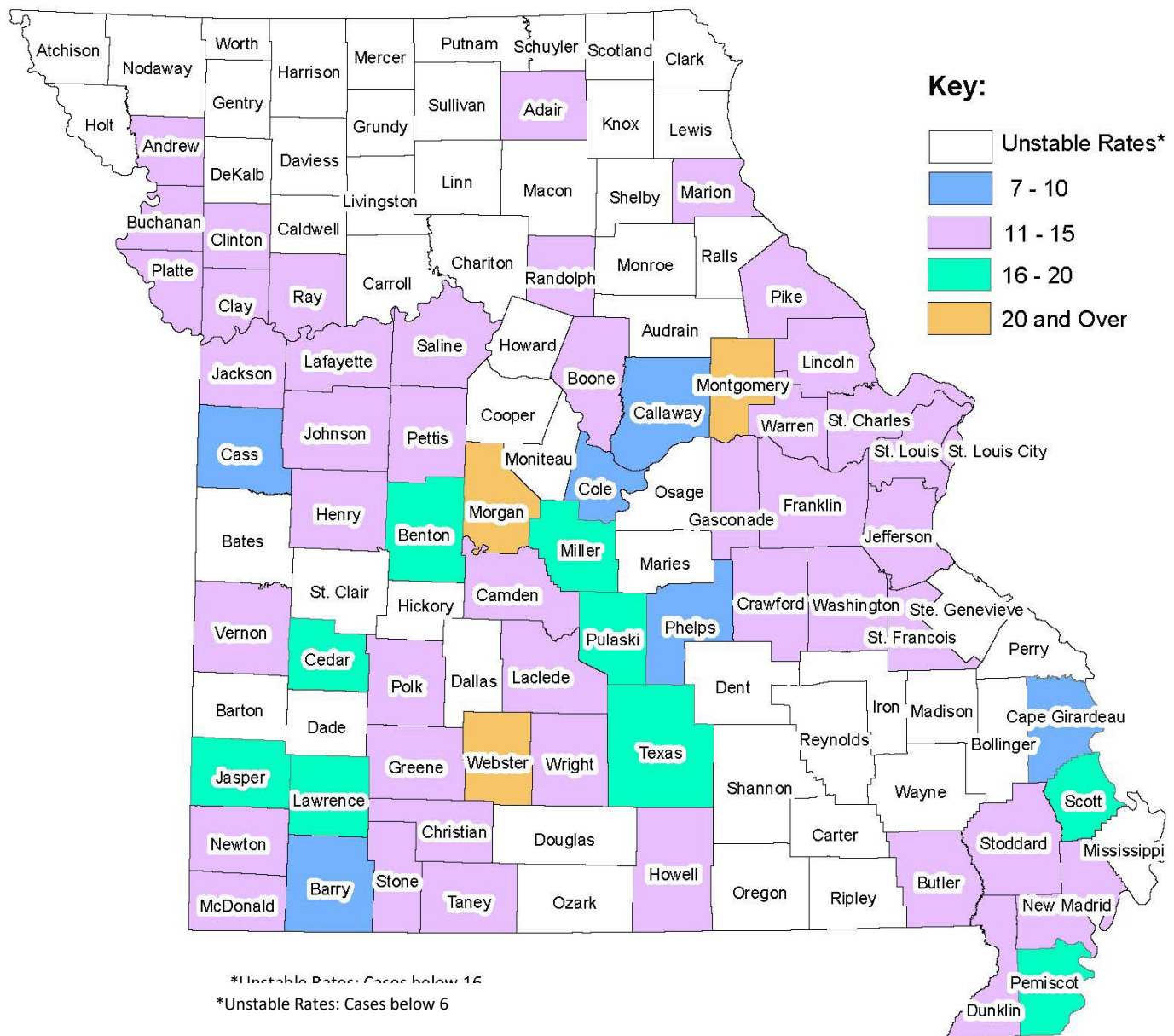
Figure 36. Nationwide Age-Adjusted Oral Cavity and Pharynx Cancer Incidence Rate per 100,000 Population, 1999-2016



Data Source: United States Cancer Statistics

Figure 37.

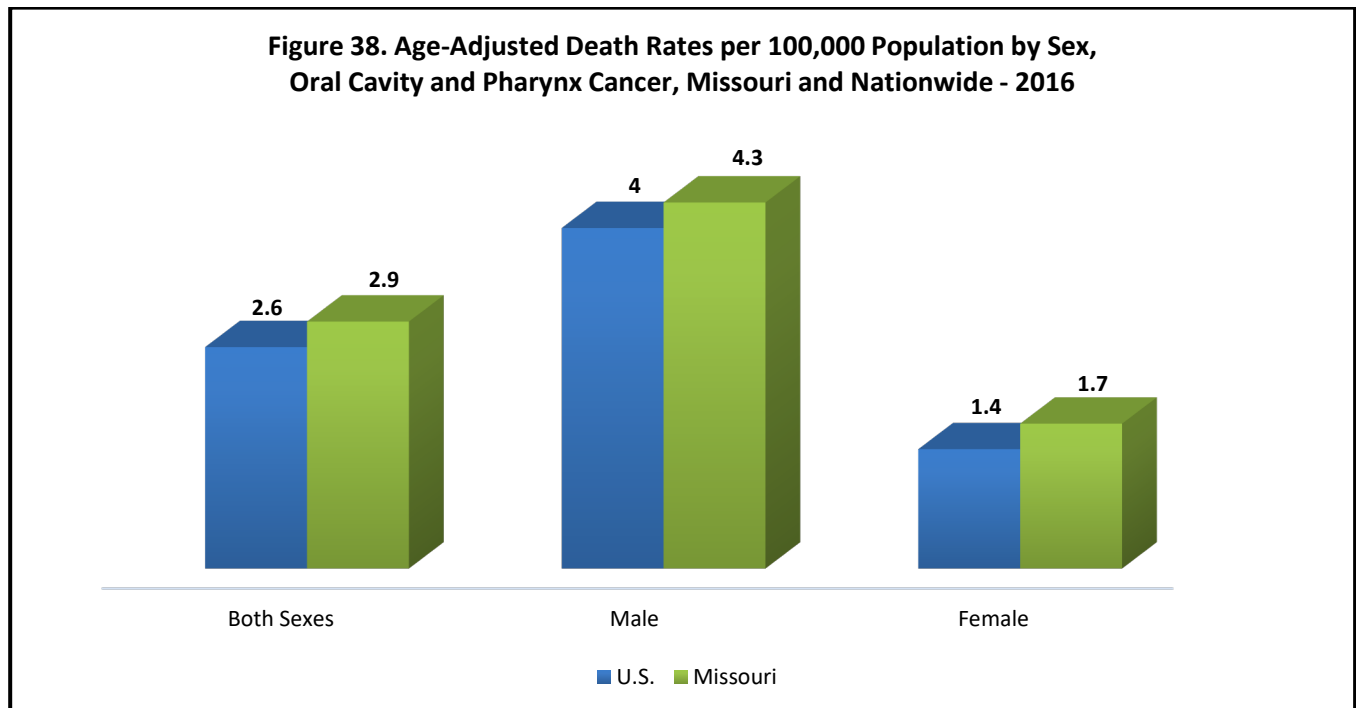
Oral Cavity and Pharynx Cancer Incidence, Missouri - 2012-2016



Source: U.S. Cancer Statistics
Missouri Department of Health and Senior Services

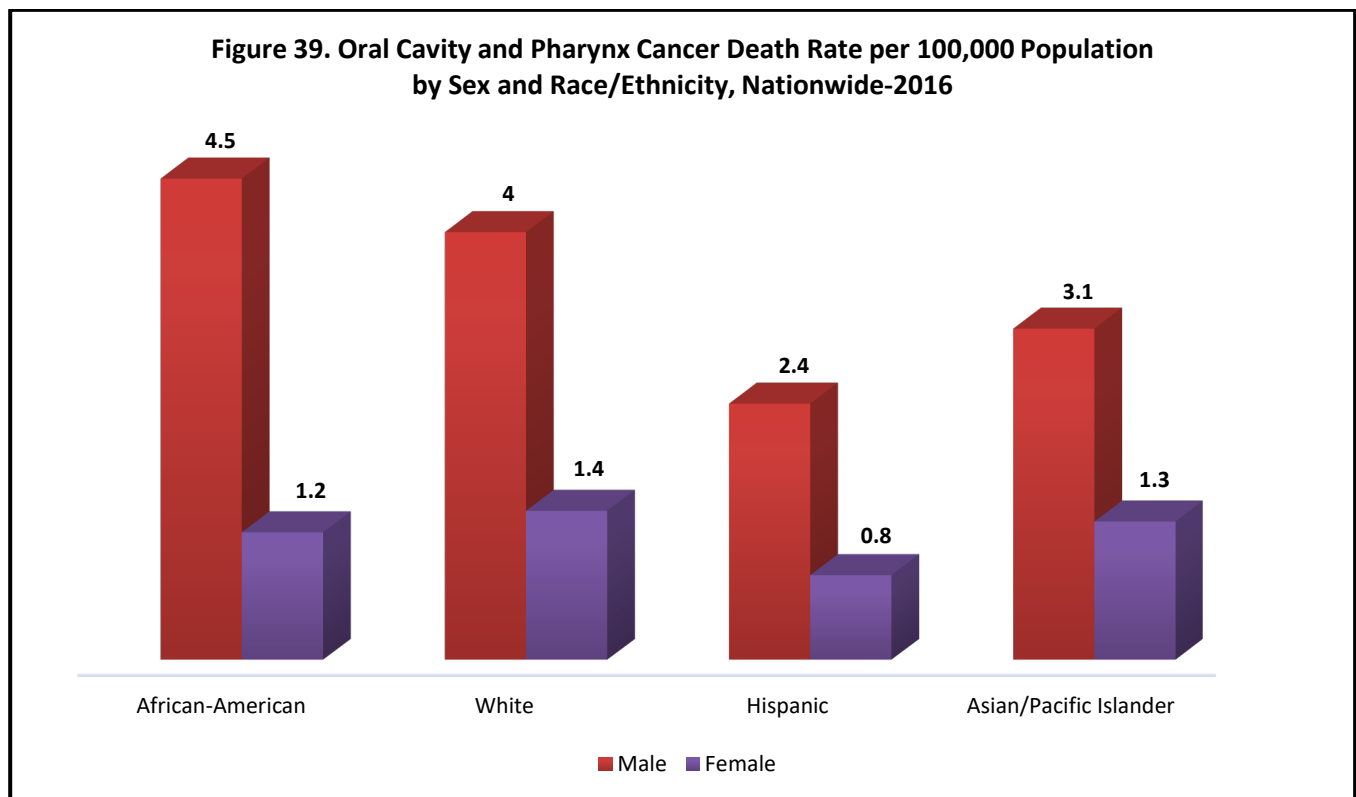
Office: Office of Dental
Health Initial: MG
Date Printed: March 2020

Death rates attributable to cancer of the oral cavity and pharynx were higher among males than females among Missouri residents and nationally.



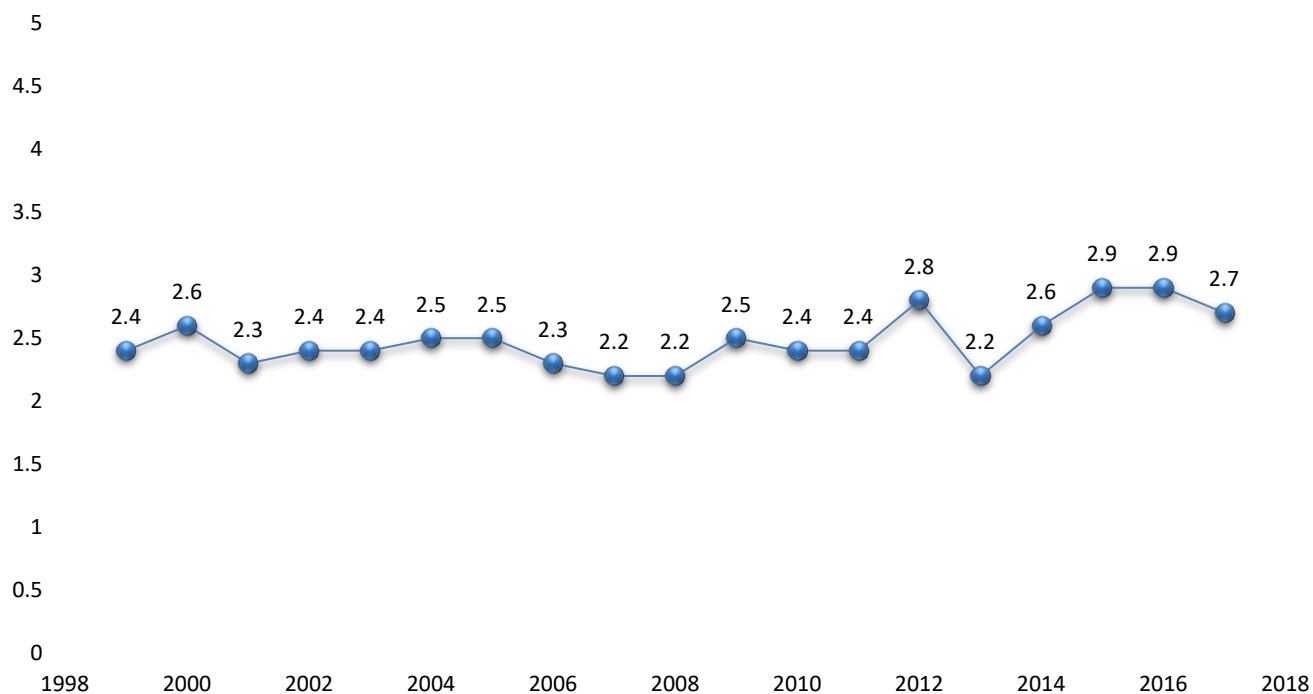
Data Source: United States Cancer Statistics

Nationally, death rates were higher among males among each race and ethnic group than females.



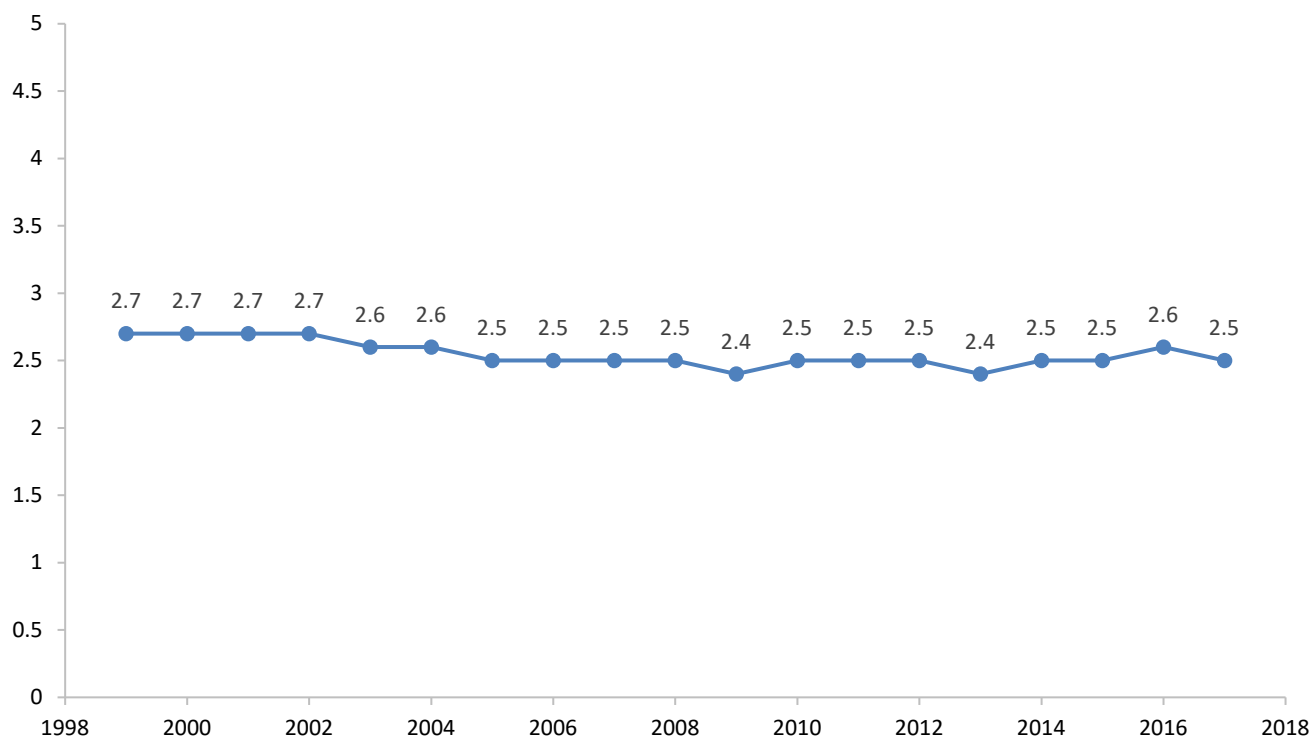
Data Source: United States Cancer Statistics

Figure 40. Oral Cavity and Pharynx Cancer Mortality Rate per 100,000 Population, Missouri 1999-2016



Data Source: United States Cancer Statistics

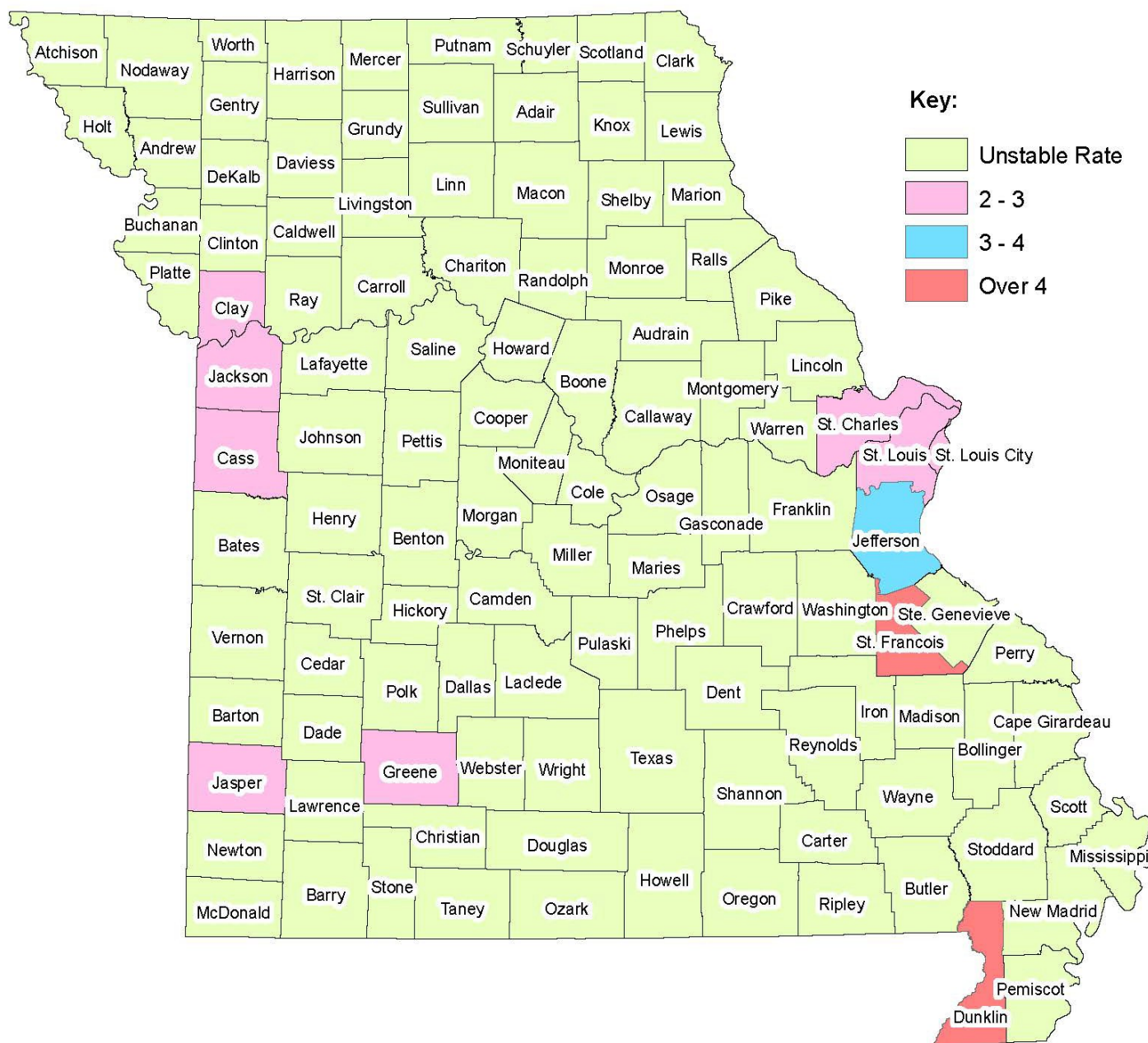
Figure 41. Nationwide Oral Cavity and Pharynx Cancer Mortality Rates per 100,000 Population, 1999-2016



Data Source: United States Cancer Statistics

Figure 42.

Oral Cancer Death Rates, Missouri 2012-2016



Source: U.S. Cancer Statistics
Missouri Department of Health and Senior Services

Office: Office of Dental
Health Initial: MG
Date Printed: March 2020

Older Adults

Older adults in general are at increased risk of periodontal disease. They may also take prescription and over-the-counter drugs that lead to dry mouth, which increases the risk of oral disease. The Surgeon General's report [Oral Health in America](#) also states that individuals living in nursing facilities are prescribed an average of eight drugs, so this risk may be greater among this group than other older Missourians. Influencing all of this is the fact that Medicare does not reimburse its recipients for routine dental care.

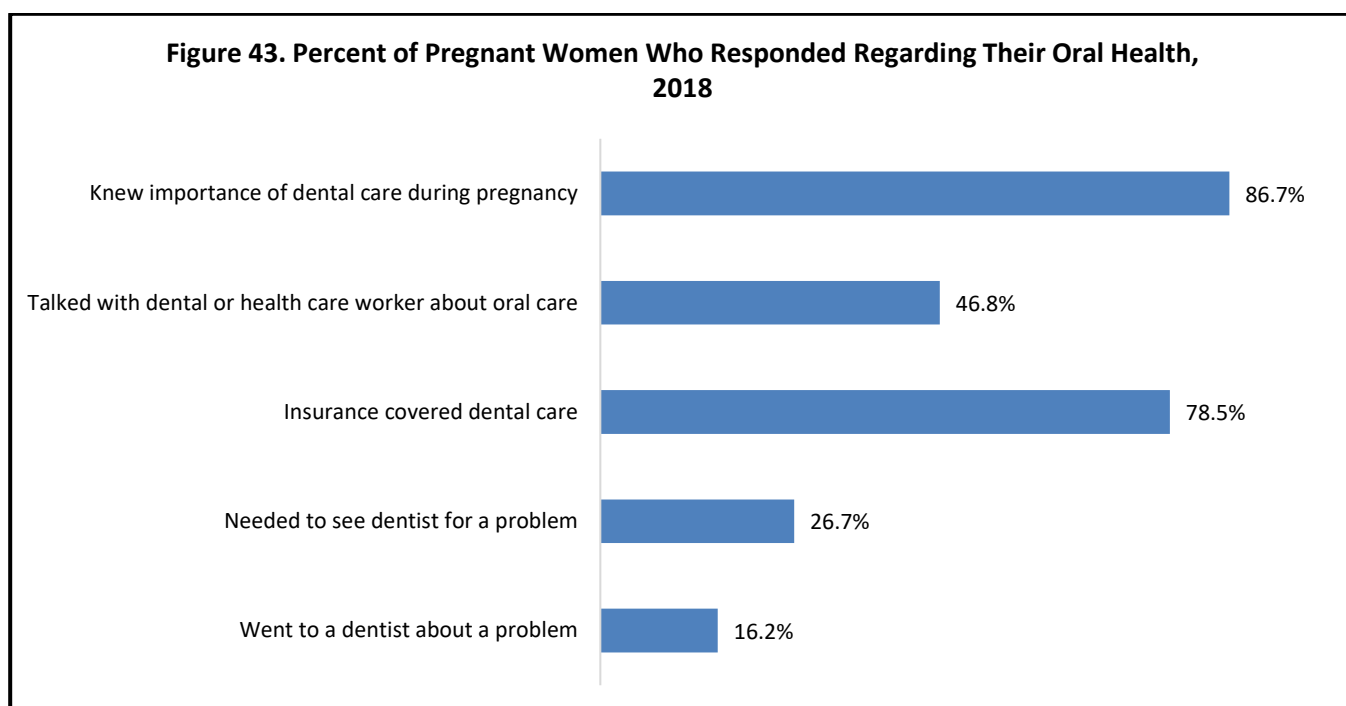
Perinatal Oral Health

As discussed in the Methodology section, PRAMS is a population-based surveillance system that includes the participation of the majority of states nationwide, including Missouri. PRAMS includes questions on a variety of maternal and infant health topics including prenatal care, folic acid consumption, postpartum depression and oral health.⁸

The PRAMS oral health questions are of particular interest because poor oral health during pregnancy can adversely impact both mother and child. A woman's susceptibility to oral infections like periodontal disease may result from changes that occur during pregnancy. Nearly half of all women experience "pregnancy gingivitis" which is a mild inflammation of the gums during pregnancy. Periodontal disease during pregnancy has been linked to low birth weight in infants, pre-term birth, gestational diabetes and pre-eclampsia. Dental treatment is safe during pregnancy and provides an excellent opportunity to discuss good oral hygiene and nutrition.²⁷

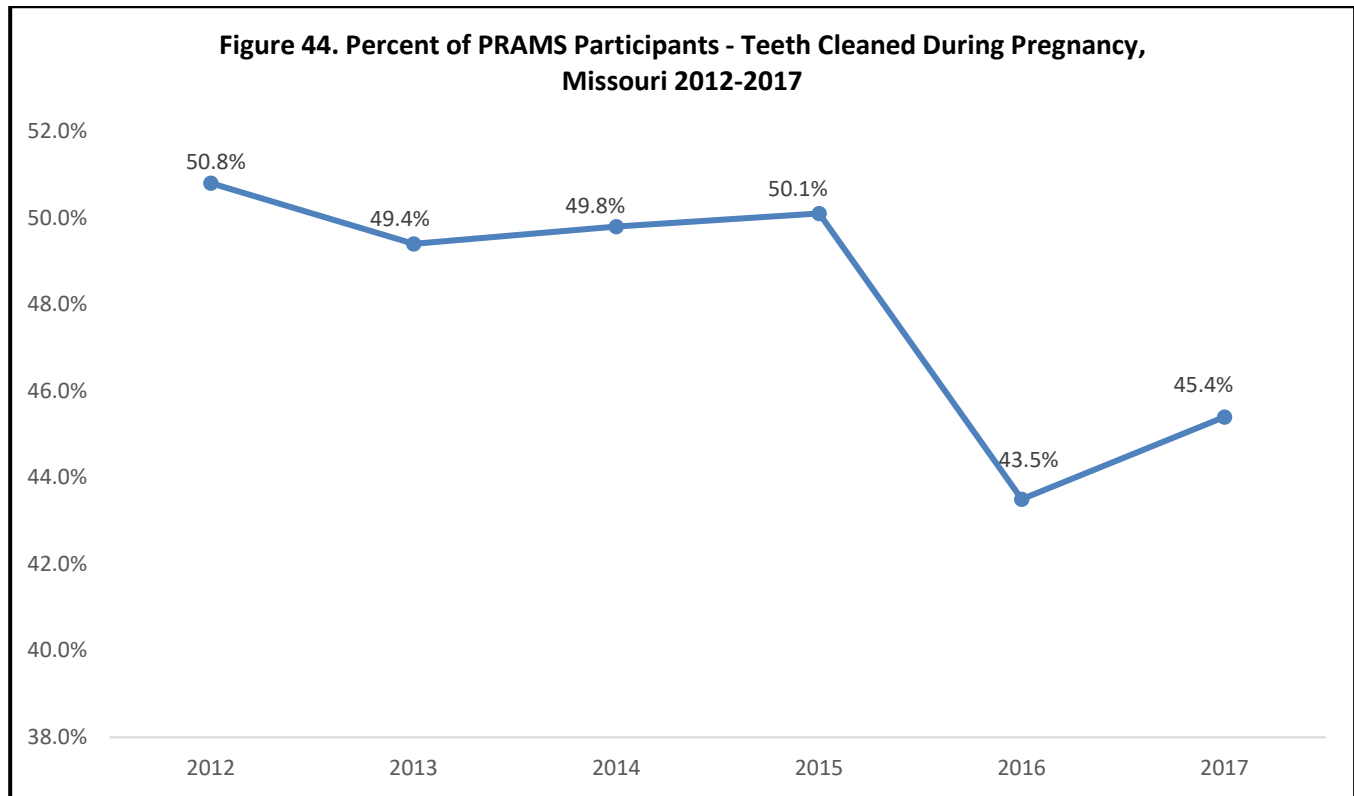
In 2018, about 26.7% of all Missouri women surveyed reported that they needed to see a dentist during their most recent pregnancy for an oral health problem.

In 2018, 46.8% of pregnant women discussed with dental or health care providers regarding their oral health and about 78.5% of them had insurance that covered dental care.

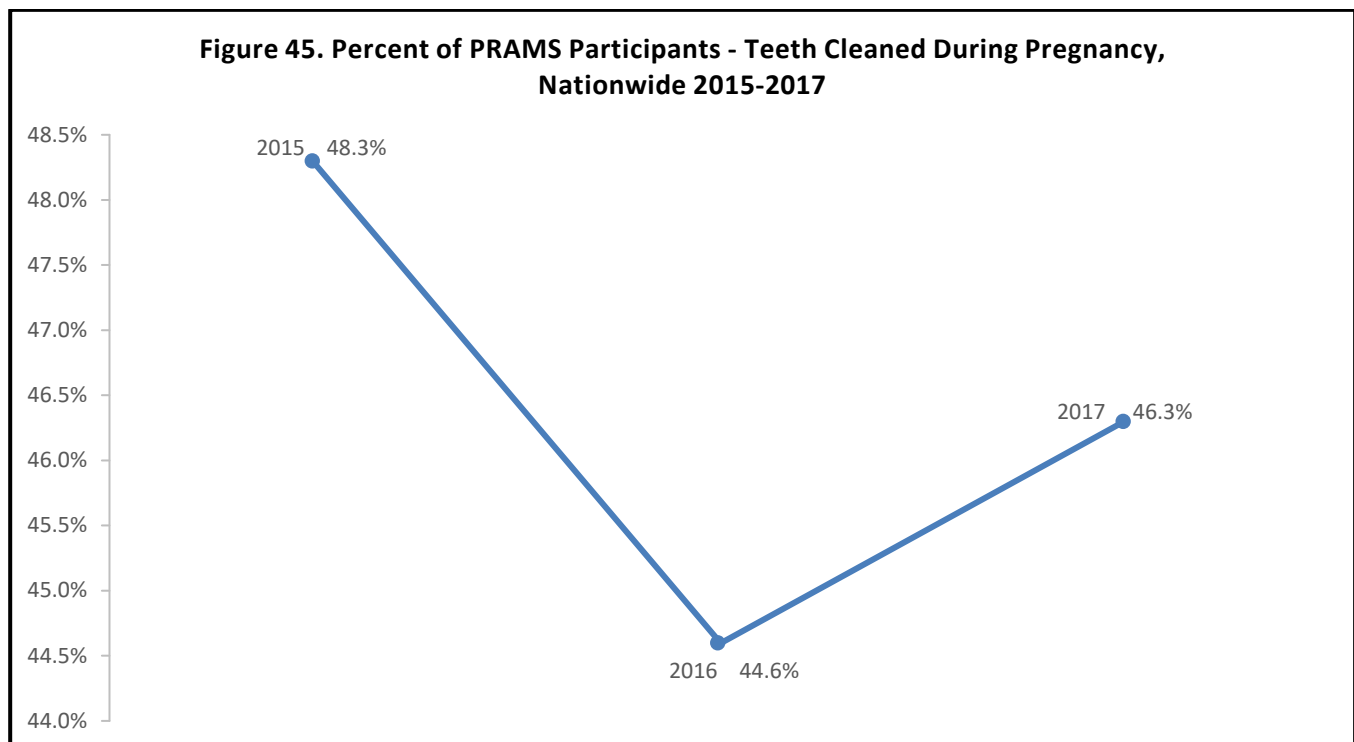


Data Source: Missouri PRAMS Program

Although it is safe to have teeth cleaned during pregnancy²⁸, only 45.4% of Missouri women reported having their teeth cleaned during their most recent pregnancy, according to the 2018 CDC PRAMS results. A dramatic decrease was seen in 2016, dropping to 43.5%. In 2017, a slight increase was observed for mothers who had their teeth cleaned (45.5%). Between 2015 and 2017, similar trend was observed nationwide.

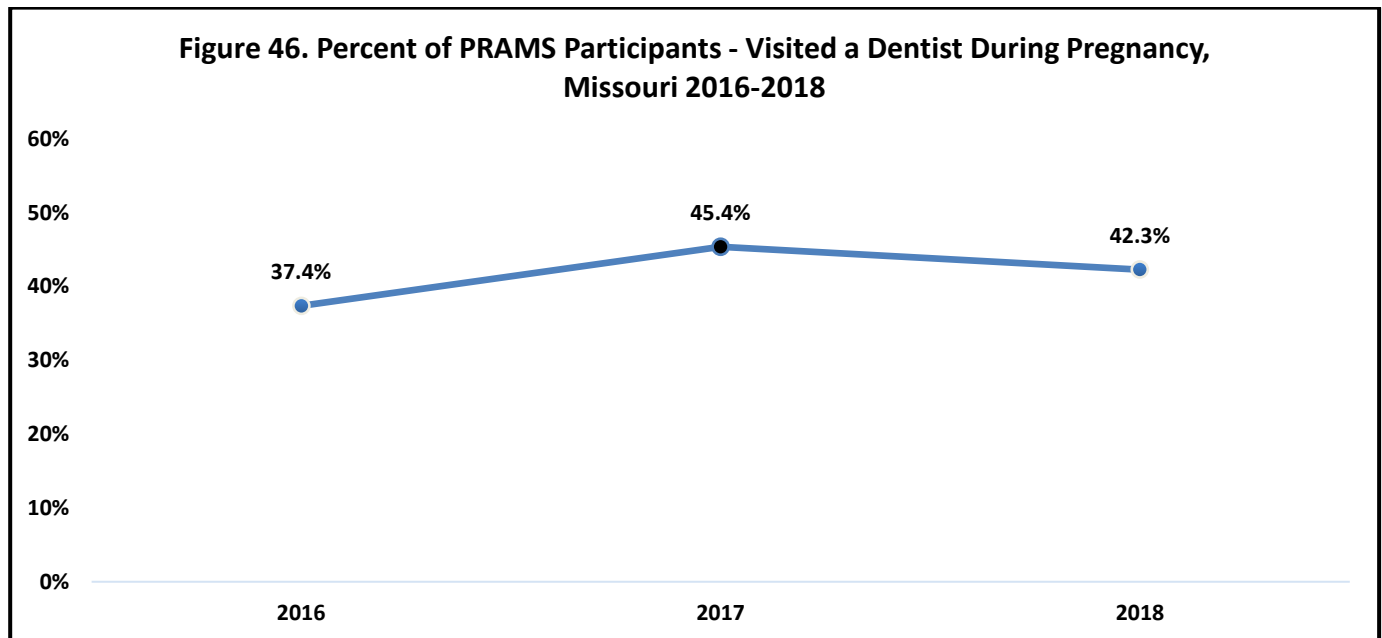


Data Source: Missouri PRAMS Program



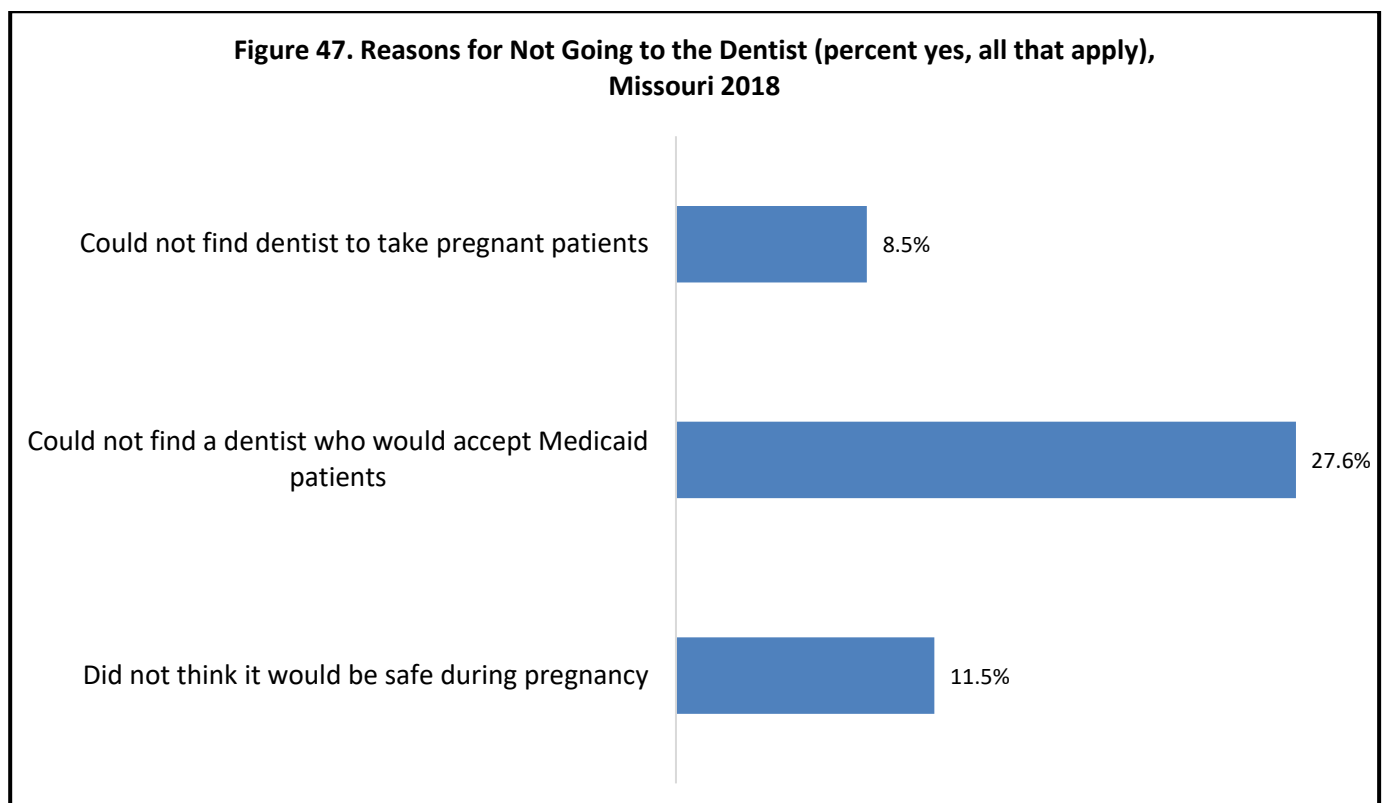
Data Source: CDC PRAMS Site

About 42.3% of women visited a dentist while pregnant. The number of pregnant women who saw a dentist while pregnant increased in 2017 (45.4%). However, the number decreased in 2018 (42.3%).



Data Source: Missouri PRAMS Program

According to Missouri PRAMS data, about 27.6% of the women reported that they could not find a dentist who would accept Medicaid patients. While about 11.5% of them thought it was unsafe to see a dentist while pregnant, less than 9% also reported lack of dentist who would see pregnant women was the reason for not seeking dental services while pregnant.



Data Source: Missouri PRAMS Program

Hospitalizations and Emergency Department Visits

DHSS creates hospitalization and ED visit data from Patient Abstract System files and shares them via a web-query system called MICA. MICA data are aged-adjusted using the 2000 standard population; data for specific age groups are crude rates. Of particular interest are the “disorders of the tooth and jaw” within the “digestive disorders” category. The International Classification of Diseases version nine (ICD-9) and version 10 (ICD-10) codes included in the “disorders of the tooth and jaw” have been reviewed by DHSS-Affiliated dentists to ensure they represent complaints that specifically exclude injuries and malignancies. Therefore, these dental ED visits can be considered preventable and non-traumatic. Additionally, these complaints could all be treated in a dental office rather than a hospital. Furthermore, EDs generally only provide short-term relief of symptoms for this class of dental problems, which means that an additional visit to a dentist will be necessary for most patients to complete their treatment.²⁹

Missouri has seen an increase until 2017 in dental-related ED visits, as Table 16 shows below. In Missouri in 2006, there were 41,914 dental related visits to the ED. In 2016, there were 63,490. However, in 2017, there was a decrease in visits at 56,556 for dental-related complaints. Based on national estimates, an ED visit for a dental complaint costs more than \$372. Using this estimate, Missouri ED visits costs exceeded \$21 million in 2017 alone.

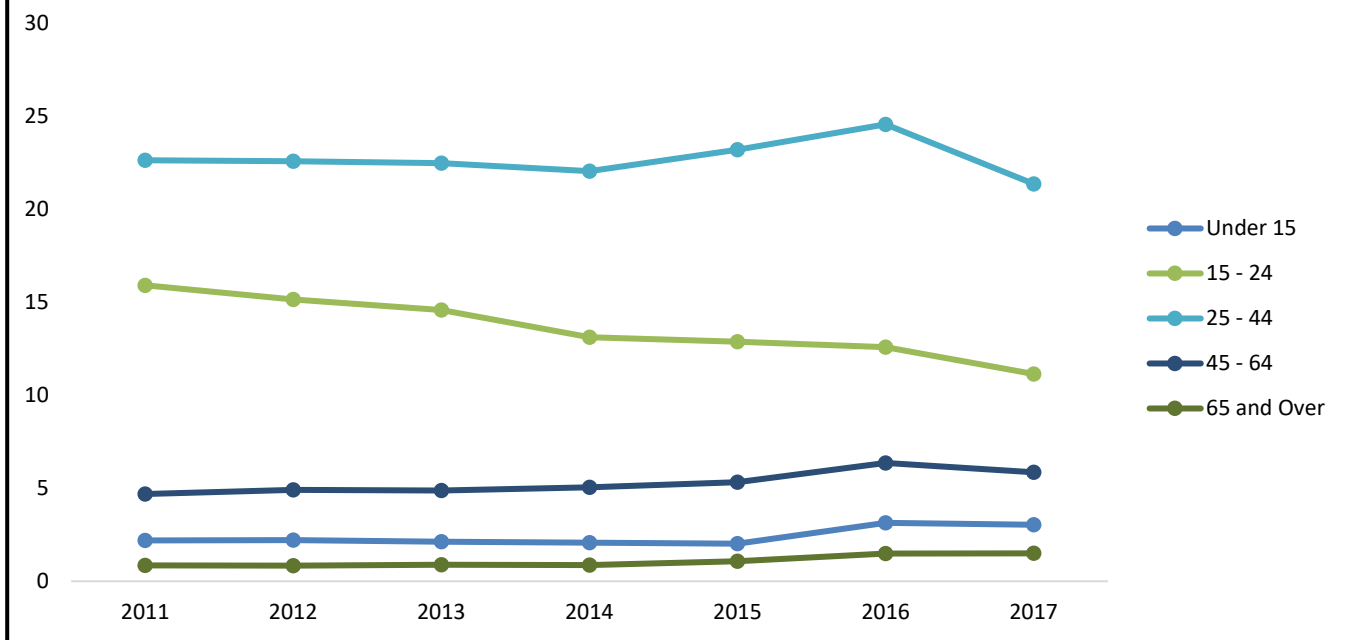
Note: Between 2015 and 2016, the diagnosis codes were changed from ICD-9 to ICD-10. The code conversion was not exactly one to one; some diagnoses are now being grouped together while others were separated out into new codes.

Table 16. Number and Rate* of ED Visits for Dental Complaints vs All Visits by Year, Missouri Residents 2006-2017				
	Dental Complaints		All Visits	
Year	Number	Rate per 1,000	Number	Rate per 1,000
2006	41,914	7.5	2,057,230	356.8
2007	48,987	8.7	2,177,183	375.3
2008	52,872	9.4	2,206,691	378.8
2009	57,281	10.1	2,194,143	375.9
2010	57,902	10.2	2,214,649	377.4
2011	58,714	10.4	2,314,348	393.9
2012	58,309	10.3	2,274,090	387.2
2013	57,641	10.2	2,231,408	378.5
2014	56,073	9.9	2,214,461	375.0
2015	58,291	10.3	2,317,458	391.0
2016	63,490	11.2	2,339,913	407.8
2017	56,556	10.0	2,350,616	407.1

Data Source: ED MICA: *Rates are age-adjusted using the 2000 Standard Population.

When comparing the number of ED visit for dental complaints for the years 2011 through 2017 by age groups, the highest rates were observed among individuals 15 to 44 years of age. The lowest rates were among younger (under 15 years old) and oldest (65 + years old) groups. In 2017, the rate of ED visits for dental complaints decreased in the age groups 15 to 64 compared to 2016. The rate of ED visits in 2017 remained the same as 2016 in the groups Under 15 and 65 + years of age, see Figure 48.

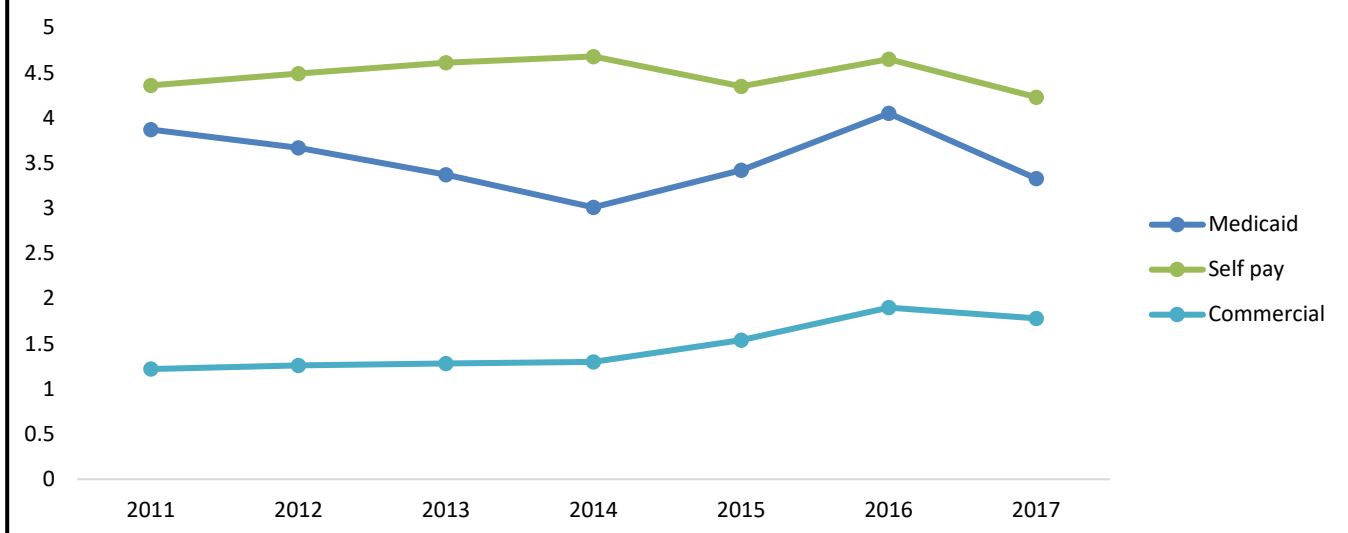
Figure 48. Dental Complaints - ED Visit Rate per 1,000 Population by Age Group and Year, Missouri 2011-2017



Data Source: ED MICA

When comparing payment sources by ED visits for dental complaints for the years 2011 through 2017, Self-Pay rates were the highest followed by Medicaid with Commercial have the lowest rates. Self-Pay and Medicaid saw increases and decreases during the years compared, as seen in Figure 49. Commercial has seen increases with a small drop from 2016 to 2017. Self-Pay and Medicaid saw a drop in the rates from 2016 to 2017 as well. Self-Pay is considered a proxy measure for the uninsured. These data are for the expected payment source upon discharge from the ED. Therefore, it is unclear whether patients in the Self-Pay category ultimately pay for the care they have received. The Commercial payment sources billed by hospitals are medical insurance providers rather than dental insurance providers.

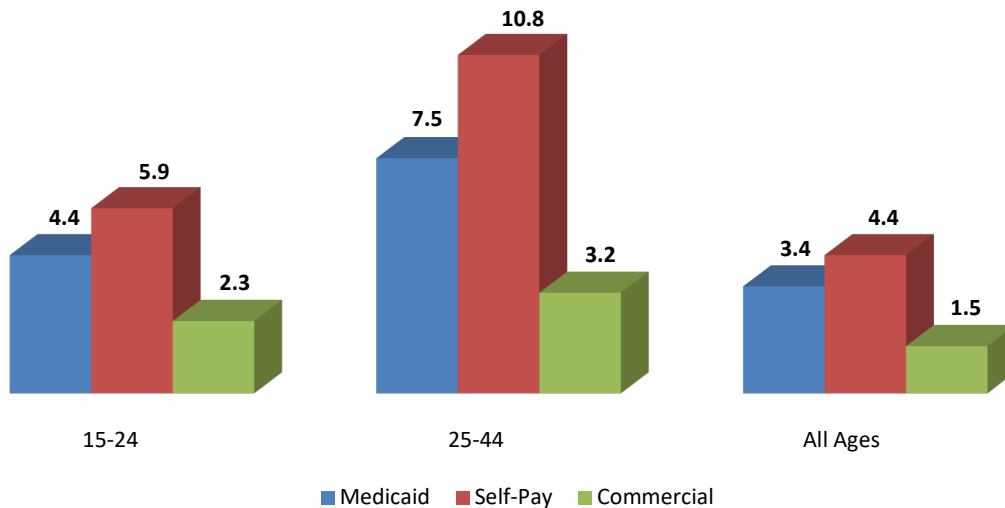
Figure 49. Dental Complaints - ED Visit Rate* per 1,000 Population by Payment Source, Missouri 2011-2017



Data Source: ED MICA

In 2015, the highest dental ED Visit rates were among adults 25 to 44 years of age. Among this group, Self-Pay was the most common expected payment source, followed by Medicaid. Self-Pay was also a method of payment for individuals younger than 24 years of age. It is important to note that the majority of individuals eligible for dental benefits in Missouri's Medicaid system are younger than 20 years old.

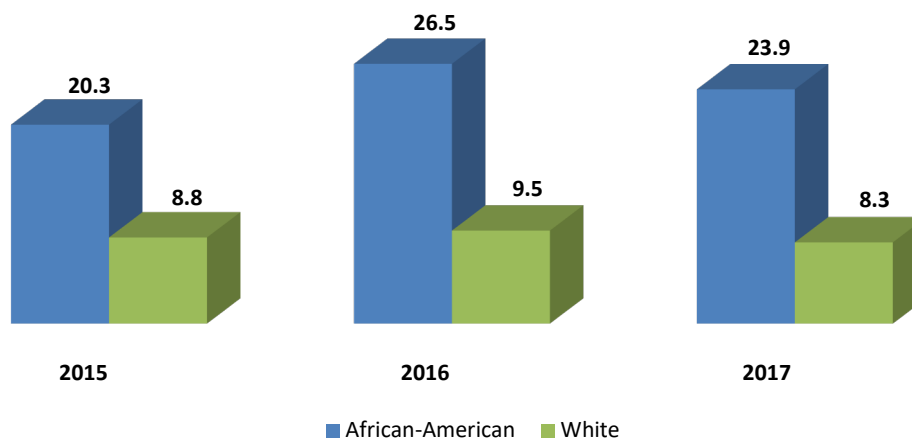
Figure 50. Dental Complainants - ED Visit Rate per 1,000 by Payment Source and Age Group, Missouri Residents - 2015



Data Source: ED MICA

When comparing ED visit rates for dental complaints between 2015 through 2017, African-Americans had higher rates than Whites did. The rates over the years had similar trends between both races. An increase in rates was observed in 2016 and declined in 2017.

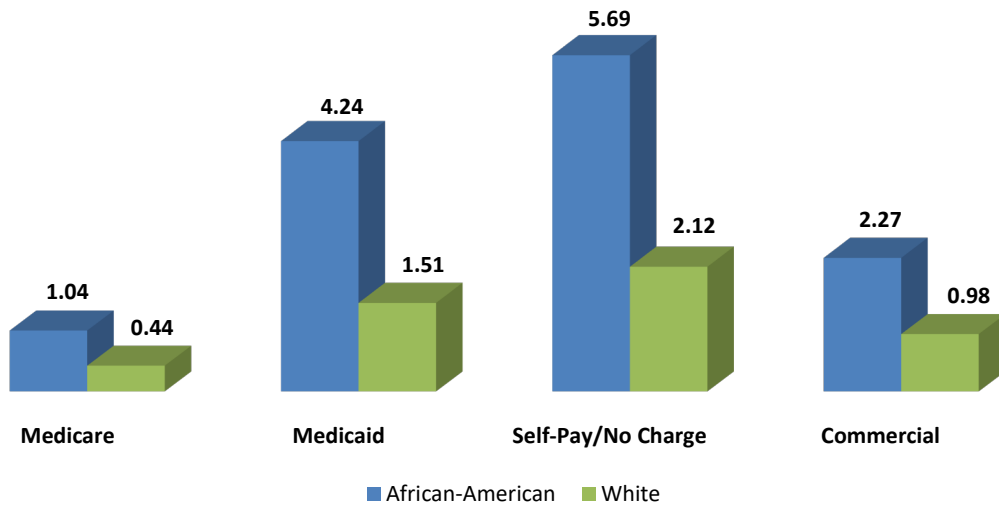
Figure 51. Dental Complaints - ED Visit Rate* per 1,000 by Race, Missouri Residents 2015-2017



Data Source: ED MICA: *Rates are age-adjusted using the 2000 Standard Population.

When ED visit for dental complaints was examined by race and payment source, higher ED visit numbers were observed for African-Americans in each payment category. Self-Pay followed by Medicaid were the two most frequently listed payment sources among both African-Americans and Whites.

Figure 52. Missouri Dental Related ED Visits, 2017



Data Source: ED MICA

Inpatient hospitalizations rarely result from disorders of the tooth and jaw. In 2017, only 272 inpatient admissions for dental complaints were recorded, which is lower than inpatient admissions from the year before, see Table 17 below. The lower inpatient admissions in 2017 could be associated with the decrease in ED visits from 2016 to 2017.

Even though inpatient admission for dental complaints are rare, they did result in 822 total days of care in 2017 and nearly \$5.9 million in total charges. It is important to note that the total charge figure reported is just for billed charges associated with the hospital stay and does not necessarily reflect the cost or final reimbursed amount.

Table 17. Dental Complaints - Inpatient Hospitalization Data, Missouri Residents 2016-2017

Pay Source	2016			2017		
	Number of Discharges	Total Length of Stay	Total Charges	Number of Discharges	Total Length of Stay	Total Charges
Medicare	93	327	\$2,950,639.00	73	302	\$1,815,534.00
Medicaid	81	200	\$1,051,910.00	56	123	\$847,217.00
Self-Pay/No Charge	51	132	\$1,023,211.00	74	204	\$1,421,174.00
Commercial	92	282	\$3,224,671.00	62	168	\$1,630,497.00
Other	8	21	\$237,479.00	7	25	\$168,794.00
All Pay Sources	325	962	\$8,487,910.00	272	822	\$5,883,216.00

Data Source: ED MICA

The rate of inpatient admissions between 2011 and 2012 increased by about 10%. The rate of admissions dropped each year between 2012 and 2017 by a total of 45% with the cost of charges dropping by \$7.5 million, see Table 18.

Table 18. Dental Complaints - Hospital Discharges, Missouri Residents 2011-2017		
Year	Number of Discharges	Charges
2011	548	\$12,223,378.00
2012	610	\$13,451,285.00
2013	582	\$12,848,123.00
2014	572	\$14,768,376.00
2015	552	\$14,780,477.00
2016	325	\$8,487,910.00
2017	272	\$5,883,216.00

Data Source: ED MICA

Access to Care

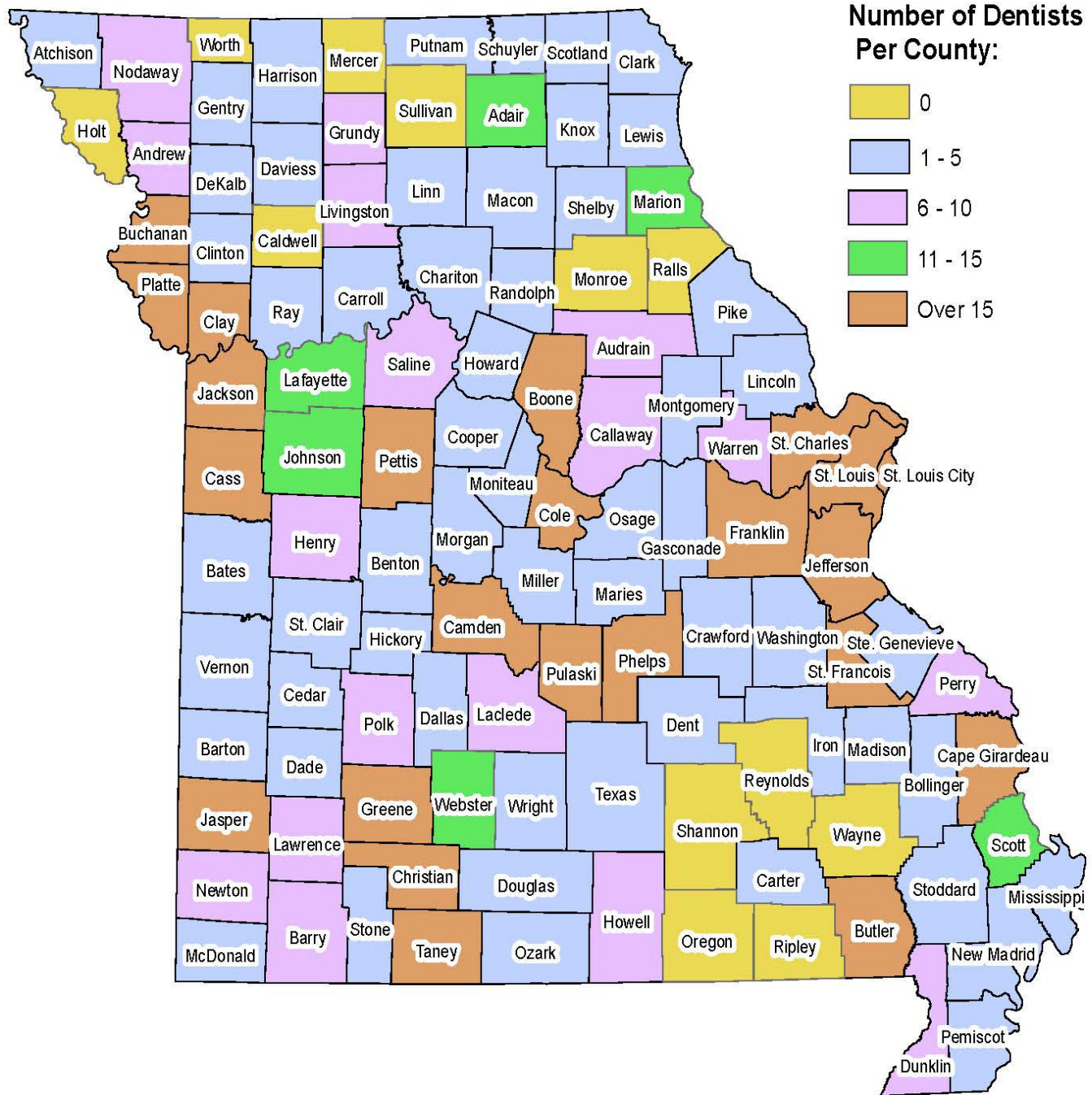
Dental Health Professionals

Dental professionals include dentists, registered dental hygienists and dental assistants. The Missouri Dental Board requires each dentist and hygienist to obtain a license in order to practice in Missouri, which allows for the oral health workforce to be assessed. It is important to note that workforce data do not take into consideration the number of hours worked per week, productivity or particular oral health burden of each population; rather, the numbers are reported as a baseline to understand broad workforce needs in Missouri.

Dentists may work within many specialties including but not limited to general dentistry, pediatric dentistry, oral surgery and orthodontics. According to data compiled in 2019, of the 3,507 dentists, 2,594 dentists licensed by the Missouri Dental Board reported a Missouri address. Missouri has 1 dentist per 2,362 residents. According to definitions used by the DHSS Office of Rural Health and Primary care, the dentist-to-population ration in urban areas is 1 per 1,959, which is in sharp contrast to the ration in rural areas (1 per 3,959 residents). There were no dental licensees in 12 Missouri counties, all of which are rural.

Figure 53.

Dentists Per County, 2019

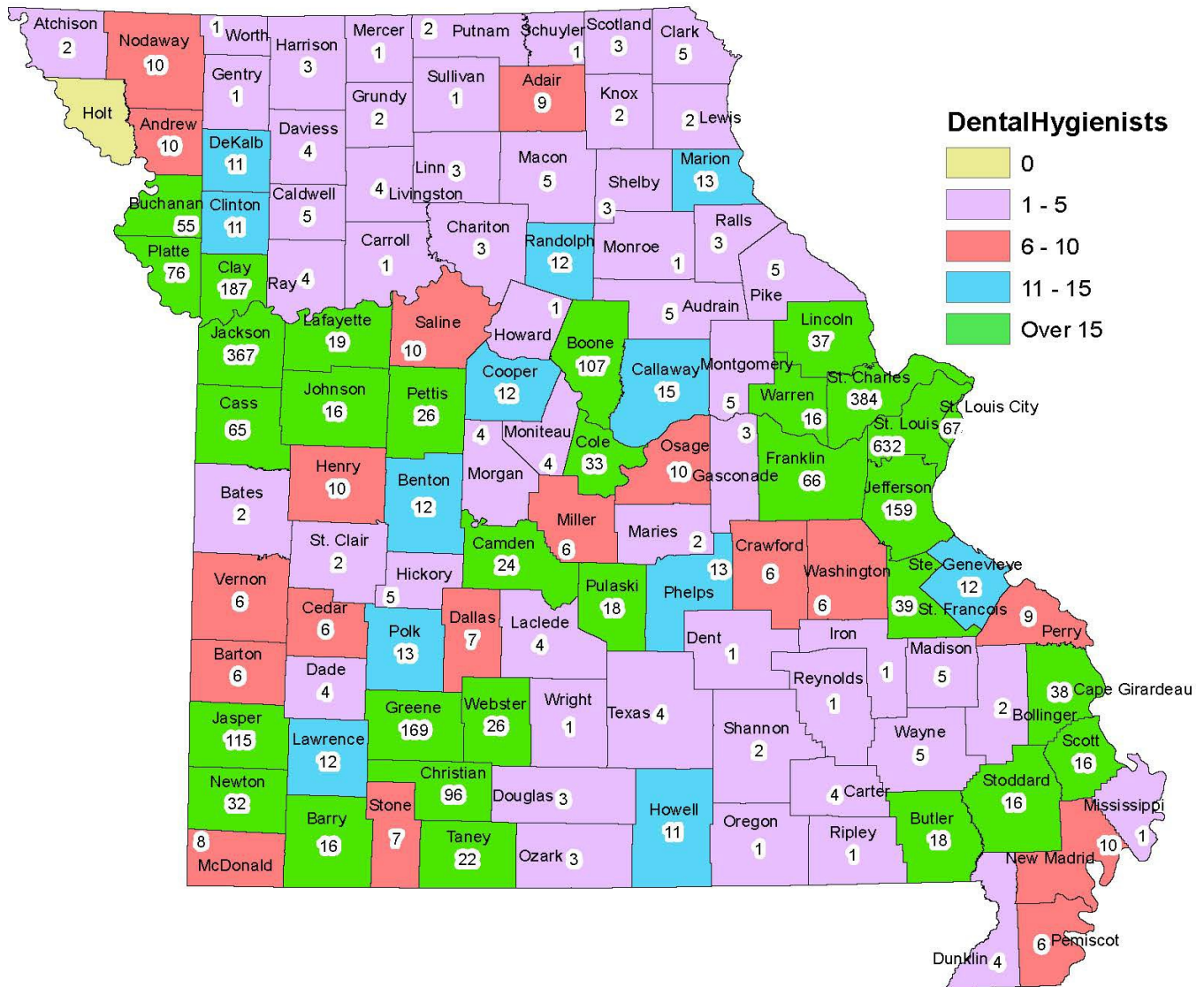


Office: Office of Dental Health
Initial: MG
Date Printed: March 2020

Dental hygienists work alongside dentists to provide preventive dental care, perform dental cleanings and examine patients for signs of oral disease. Missouri has 1 dental hygienist per 1,809 residents. According to data compiled in 2019, of the total 4,368 dental hygienists, 3,387 of dental hygienists licensed by the Missouri Dental Board reported a Missouri address. The hygienist-to population ration in urban area was 1 per 1,572 residents and 1 per 2,567 residents in rural areas. Additionally, there were no hygienist licensees reporting addresses in one rural county in Missouri.

Figure 54.

Dental Hygienist Per County, 2019



Federally Qualified Health Centers (FQHC) are health centers supported by the Health Resources and Services Administration (HRSA) that are community-based, located in defined high needs communities and focused on serving population with limited access to health care.¹² Currently there are 29 FQHCs in Missouri.

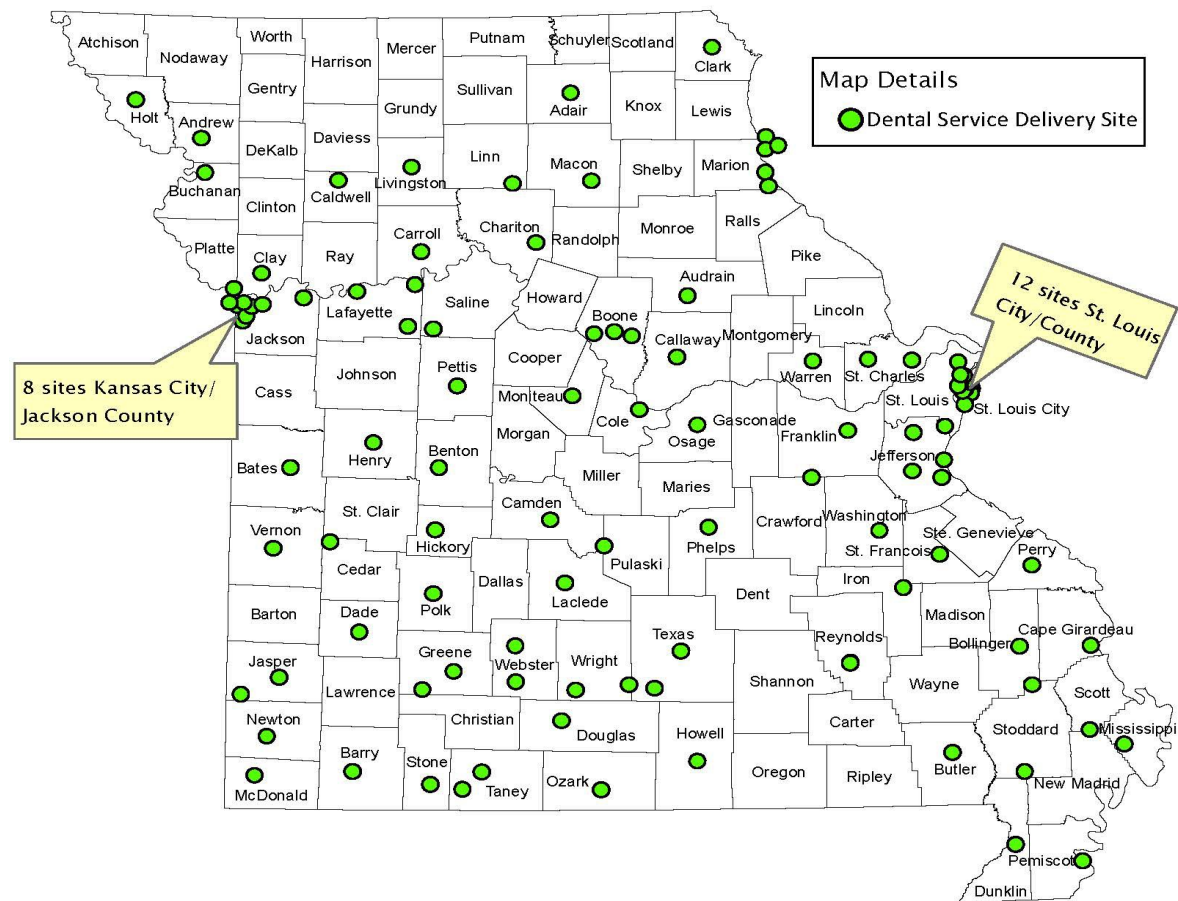
FQHCs provided services to 527,054 patients, of which 72% were at or below 100% of Poverty level, 136,333 had no insurance (25.9%), and 242,235 were on Medicaid and CHIP (46.0%).²⁸ In 2018, FQHCs employed a total of 165.2 full-time equivalent (FTE) dentists who provided services to 223,954 patients.

A Dental Health Professional Shortage Area (HPSA) represents an area that lacks access to dental care due to excessive distance, over-utilization of available providers or other barriers to dental care. There are 95 Dental HPSA designations in Missouri and 75 of them are located in rural areas.¹²

There are 1,730,257 Missourians (roughly 28.2% of the total population) within dental HPSAs. Based on dentist-to-population ratio in these Dental HPSAs, a total of 375 dentists are needed to meet the needs of these residents and remove the Dental HPSA designations. Of those individuals residing within Dental HPSAs it is estimated that only 12.5% (765,807) Missourians are currently having their needs met in regards to oral health services.

Figure 55.

Dental Delivery Sites – 2019



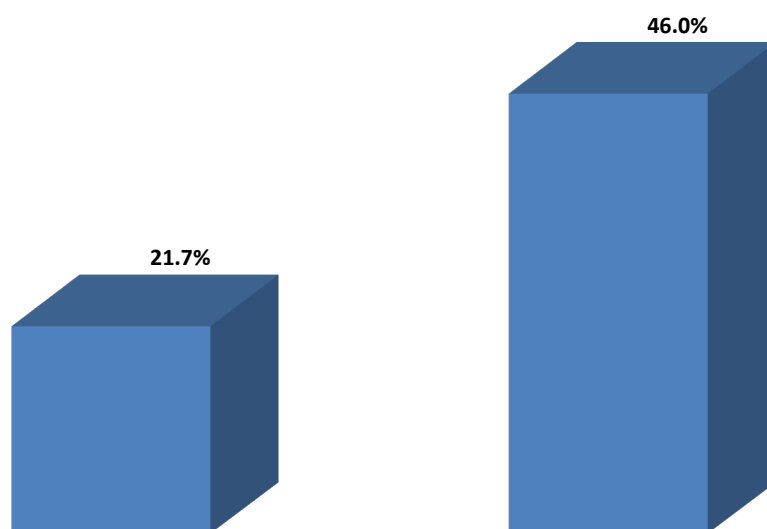
Office: Office of Dental Health
Initial: MG
Date Printed: March 2020

Dental Coverage

Information on the number of Missourians with dental coverage is difficult to ascertain. The Surgeon General's Report states that for every adult 18 years of age and older without health insurance coverage, there are three without dental coverage.² According to the 2018 BRFSS, about 12.4% of Missouri adults report that they do not have any health coverage at all.

There is approximately 760,000 Missouri adults without health coverage. Data is unavailable for the number of Missourians without dental coverage. According to County Level study, only 21.7% of participants, who last visited a dentist more than two years ago, indicated that they had health coverage.³⁰

Figure 56. Missourians Who Last Visited a Dentist More than Two Years Ago, 2016



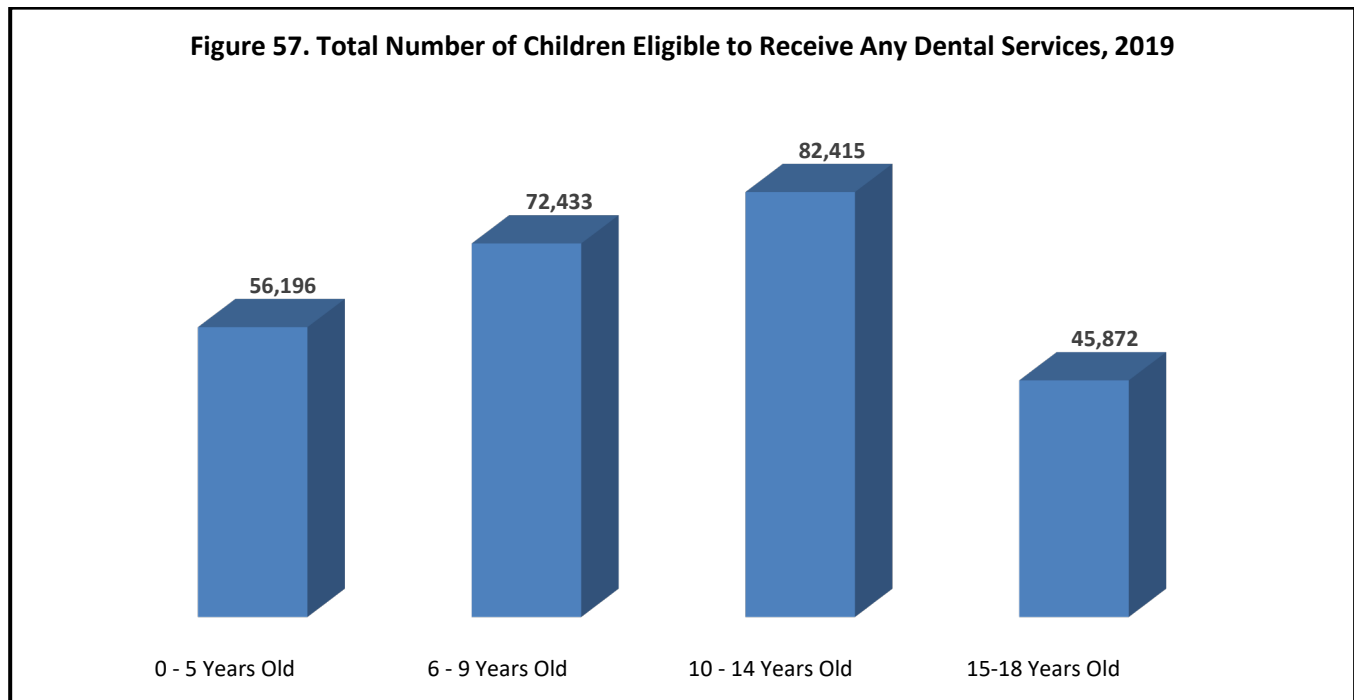
Missouri's Medicaid agency is the MO HealthNet Division within the Missouri Department of Social Services. In 2016, Missouri received approval to expand Medicaid services to adults. The program was estimated to cover 282,000 adults. According to the Medical Statistical Information System used by MO HealthNet, during State Fiscal Year 2020 (SFY20) there were 520,971 children enrolled in Medicaid for at least one month of the year. Eighty-five percent of children in Missouri are covered through managed care. In 2019, there were 562 total claims billed by provider type '40' dentist (both Fee-for-Service and Managed Care) for ages 0 to 18 year olds.

According to MO HealthNet, in State Fiscal Year 18 the utilization rates for preventive and treatment services were higher among those on Managed Care than Fee-for-Service beneficiaries.

Table 19. MO HealthNet Utilization Rates for Dental Services - State Fiscal Year 2018

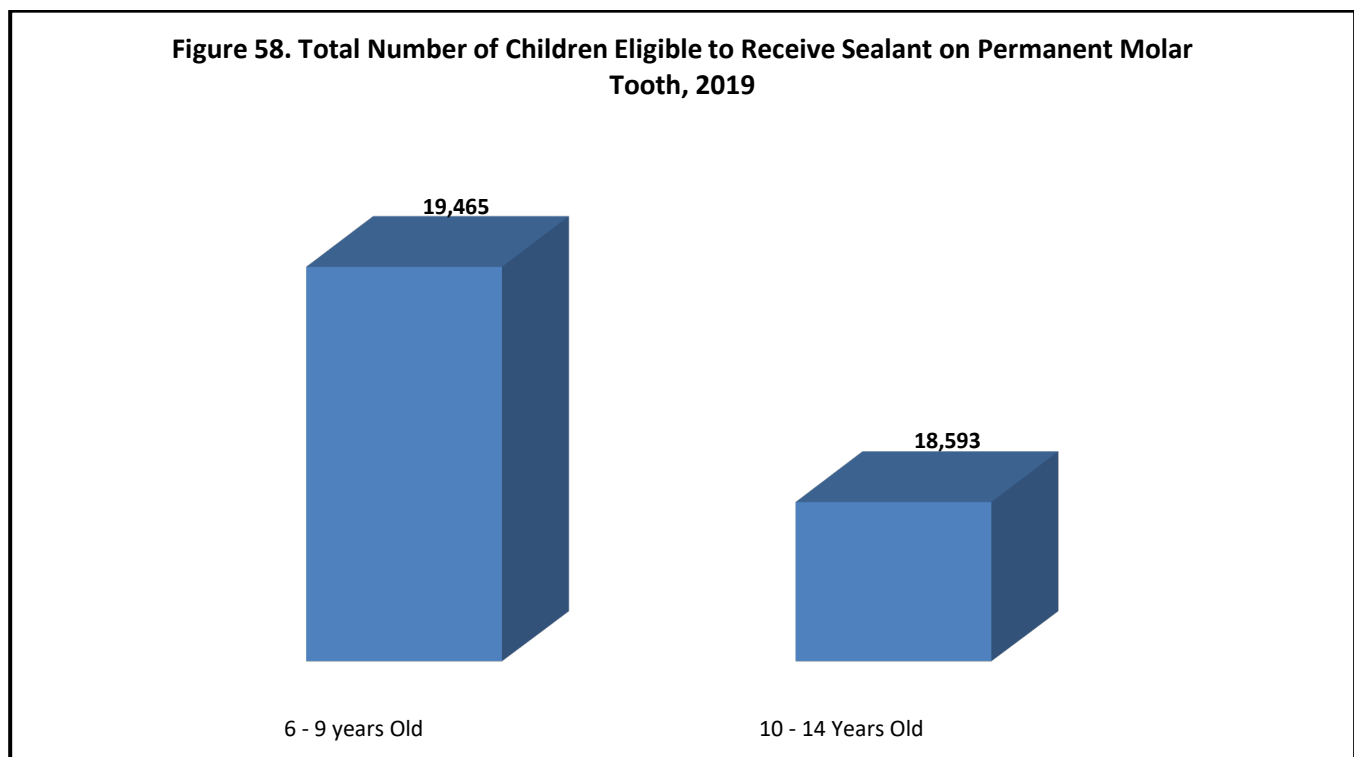
	Fee-for-Service	Managed Care
Any Dental Services	3,450	259,162
Preventive Dental Services	3,085	235,085
Treatment Services	1,376	109,365

Data source: Mo HealthNet Division, Medical Statistical Information System
In 2019, there were 256,916 children (0 – 18) who were eligible to receive any dental services.



Data Source: Mo HealthNet Division, Medical Statistical Information System

There were 38,058 of the children between 6 through 14 years old who were eligible to receive dental sealants on a permanent molar tooth.



Data Source: Mo HealthNet division, Medical Statistical Information System

Conclusions

The purpose of Oral Health in Missouri 2020 was to review existing data and determine what the ODH needs to address next in terms of surveillance, intervention development and program planning. Additionally, this report is intended to inform the public, communities and decision makers about Missouri's current oral health status and present recommendations for action.

Next Steps

The State Oral Health Plan was completed in 2019 with the assistance of oral health stakeholders representing many different disciplines and geographic areas within Missouri. Key findings from this report were shared with State Oral Health Plan task force to provide context and direction during the planning process. The State Oral Health Plan hopes to accomplish the following goals in the next five years:

Goal 1: Support and enhance access to preventive oral health services and appropriate emergency dental care.

Goal 2: Provide up-to-date, evidence-based oral health information and best practices to medical and oral health professionals.

Goal 3: Support the development of the oral health workforce.

Goal 4: Identify, investigate, monitor and report on oral health problems, determinants and disparities.

Goal 5: Coordinate and participate in policy development aimed at improving oral health in Missouri.

Goal 6: Implement and collaborate with programs that focus on prevention of oral disease.

Goal 7: Increase awareness to reduce oral health disparities across the lifespan.

Goal 8: Implement, evaluate and report on the Missouri Oral Health Plan 2020-2025.

<https://health.mo.gov/living/families/oralhealth/pdf/oral-health-plan-2020-2025.pdf>

The ODH has also planned to complete other oral health surveillance activities, including updating Oral Health in Missouri annually, developing fact sheets on special topics, a surveillance plan and creating the Missouri Oral Health Surveillance System. A new BSS is planned for the upcoming 2024-2025 school year in order to gather more up-to-date population-based data on the oral health of Missouri's children. This will include a survey of parents and guardians to assess oral health practices in the home, dental coverage and frequency of dental visits.

In the process of creating Oral Health in Missouri, the ODH determined that there is a need to assess the risk and prevalence of periodontal disease and to gather information on dental coverage in Missouri. The state planning process and development of this report also informed the ODH that more local and regional data should be sought to assist partners and communities in addressing oral health topics.

Recommendations

- Many communities are facing economic and other pressures that affect their ability to begin or maintain CWF. This will impact Missouri's ability to retain or improve its current CWF status, which is better than the national average, so increased education and other resources on CWF are recommended.

- Missouri's dental sealant prevalence is lower than the national median; therefore, programs should aim to increase the placement of sealants among children on newly erupted permanent molar teeth.
- Based on PSP findings, Hispanic children appear to have the most serious adverse oral health outcomes of all racial and ethnic groups examined. The Spanish speaking population should be kept in mind when culturally competent and linguistically appropriate educational materials for parents and children are developed.
- All Missourians should receive more education about oral health and the importance of regular dental visits, but this is especially important for those of lower socioeconomic groups and individuals with chronic disease.
- Dentists, dental hygienists and medical providers should be educated about:
 - Oral cancer incidence, mortality and risk factors.
 - The need for good oral health among individuals with chronic disease, especially diabetes.
 - Consequences of poor oral hygiene for individuals in skilled nursing facilities as well as for older adults in general.
 - The importance of maintaining oral health during pregnancy and that it is safe to have teeth cleaned during any stage of pregnancy.
- Dentists, dental hygienists and medical providers should be involved in strategies to educate patients about:
 - Tobacco use and oral cancer risk.
 - The importance of good oral health and regular dental visits, especially for older adults and all Missourians with chronic illnesses.
 - How to maintain good oral hygiene during pregnancy.
- Increasing dental coverage of adults and children either through MO HealthNet or private insurance would decrease the risk of adverse oral health outcome such as dental caries experience, need for urgent dental care (such as ED visits) and tooth loss.
- Improvements to the number and distribution of dental professionals, especially those that serve low-income populations, are recommended in order to improve oral health outcomes and reduce the use of hospitals for non-traumatic dental complaints.

*Disclaimer: The tables look at different schools and contain different data; Table 1 data is a random sample of third grade students only where data was obtained from that random sample and Table 5 is a convenience sample of all grade levels where data is obtained from our Preventive Services Program (PSP).

References

1. U. S. Department of Health and Human Services. (2000). *Oral Health in America: A Report of the Surgeon General*: <https://www.nidcr.nih.gov/sites/default/files/2017-10/hck1ocv.%40www.surgeon.fullrpt.pdf>
2. U. S. Department of Health and Human Services. (2020). *New Surgeon General's Report on Oral Health*. Retrieved on August 26, 2020 from: https://www.nidcr.nih.gov/news-events/2020-surgeon-generals-report-oral-health?_ga=2.6697138.1874830454.1598477584-697674545.1598477584
3. Missouri Department of Health and Senior Services Data Brief, July 2019. The Oral Health of Missouri's Third Grade Children Compared to the General U.S. Population. Retrieved on April 2, 2020 from: <https://health.mo.gov/living/families/oralhealth/pdf/oral-health-3rd-grade.pdf>
4. Missouri Department of Health and Senior Services. (2019). *PSP Report: Promoting Healthy Smiles through Education and Prevention*. <https://psp.health.mo.gov/wp-content/uploads/sites/13/2020/01/psp-annual-report.pdf>
5. Centers for Disease Control and Prevention. (2019). Survey Data and Documentation. *Behavioral Risk Factor Surveillance System Survey Data*. Retrieved on April 6, 2020 from: https://www.cdc.gov/brfss/data_documentation/index.htm
6. Centers for Disease Control and Prevention. (2019). BRFSS. *Behavioral Risk Factor Surveillance System Survey Data*. Retrieved on April 6, 2020 from: https://www.cdc.gov/brfss/annual_data/annual_2018.html
7. Centers for Disease Control and Prevention. (2017). Youth Risk Behavior Survey. Retrieved on April 6, 2020 from: <https://nccd.cdc.gov/youthonline/App/Results.aspx?LID=MO>
8. Missouri Department of Health and Senior Services. (2020). Missouri Pregnancy Risk Assessment Monitoring System. Retrieved on April 2, 2020 from: <https://health.mo.gov/data/prams/methods.php>
9. Missouri Department of Health and Senior Services. Population Missouri Information for Community Assessment (MICA). Retrieved on April 6, 2020 from: <https://healthapps.dhss.mo.gov/MoPhims/QueryBuilder?qbc=PNM&q=1&m=1>
10. Missourians to End Poverty (2020). 2018 Missouri Poverty Report. A Biennial Publication from Missourians to End Poverty. Retried from: https://www.caastlc.org/wpsite/wp-content/uploads/2020/06/PovertyReport_2020-reduced-size.pdf
11. United States Census Bureau. Facts for Features: Poverty Status in the past 12 Months. Accessed 8/27/20: <https://data.census.gov/cedsci/table?q=ACSST1Y2018.S1701&tid=ACSST1Y2018.S1701&hidePreview=false>
12. Missouri Department of Health and Senor Services (2019). Missouri Office of Rural Health's Biennial Report 2018-2019. Retrieved from: <https://health.mo.gov/living/families/ruralhealth/pdf/biennial2019.pdf>
13. Centers for Disease Control and Prevention (2020). Communities Benefit from Water Fluoridation, Infographic. Retrieved from: <https://www.cdc.gov/fluoridation/resources/communities-benefit-from-water-fluoridation.html>

14. Centers for Disease Control and Prevention (2016). Community Water Fluoridation: 2016 Fluoridation Statistics. Retrieved on 8/27/2020 from: <https://www.cdc.gov/fluoridation/statistics/2016stats.htm>
15. U. S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, OH-13 (2020). Retrieved from: https://www.healthypeople.gov/node/5003/data_details
16. Holt K., Barzel, R. 2013. *Oral Health and Learning: When Children's Oral Health Suffers, So Does Their Ability to Learn* (3rd Ed.). National Maternal and Child Health Resource Center. <https://www.mchoralhealth.org/PDFs/learningfactsheet.pdf>
17. U.S. Department of Health and Human Services, Oral Health in America: A Report of the Surgeon General, 2000. Retrieved from <https://www.nidcr.nih.gov/sites/default/files/2017-10/hck1ocv.%40www.surgeon.fullrpt.pdf>
18. Centers for Disease Control and Prevention (2019). Dental Sealants. https://www.cdc.gov/oralhealth/dental_sealant_program/index.htm
19. Healthy People 2020 Topics and Objectives: Oral Health. Retrieved from: <https://www.healthypeople.gov/2020/topics-objectives/topic/oral-health/objectives>
20. Centers for Disease Control and Prevention (2019). Birth Defects. <https://www.cdc.gov/ncbddd/birthdefects/facts.html>
21. Centers for Disease Control and Prevention (2019). Facts about Cleft Lip and Cleft Palate. <https://www.cdc.gov/ncbddd/birthdefects/cleftlip.html>
22. Mouth Healthy (2020). <https://www.mouthhealthy.org/en>
23. Mayo Clinic (2019). Oral health: A window to your overall health. <https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/dental/art-20047475>
24. American Dental Association, Mouth Healthy, (2020). Smoking and Tobacco. <https://www.mouthhealthy.org/en/az-topics/s/smoking-and-tobacco>
25. National Cancer Institute at the National Institutes of Health (2017). HPV Vaccination Linked to Decreased Oral HPV Infections. Retrieved on April 12, 2020 from: <https://www.cancer.gov/news-events/cancer-currents-blog/2017/hpv-vaccine-oral-infection>
26. Centers for Centers for Disease Control and Prevention (2020). 2008 through 2019 Adolescent Human Papillomavirus (HPV) Vaccination Coverage Trend Report. Retrieved from: <https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/data-reports/hpv/trend/index.html>
27. American Dental Association, Mouth Healthy, (2020). *Pregnant? 9 Questions You May Have About Your Dental Health. Why Are My Gums Bleeding?* <https://www.mouthhealthy.org/en/pregnancy-slideshow>
28. American Dental Association, Mouth Healthy, (2020). Is It Safe To Go To the Dentist During Pregnancy? <https://www.mouthhealthy.org/en/pregnancy/concerns>

29. Missouri Department of Health and Senior Services. Missouri Information for Community Assessment, Emergency Department Data 2011-2015. Retrieved from:
<https://healthapps.dhss.mo.gov/MoPhims/QueryBuilder?qbc=ERM&q=1&m=1>
30. Missouri Department of Health and Senior Services. 2016 County-Level Study.
<https://healthapps.dhss.mo.gov/MoPhims/ProfileBuilder?pc=14>